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A CHEAP AND SIMPLE ELECTRICAL INDUCTION MACHINE.

BY G. W. LUMMIS PATTERSON.

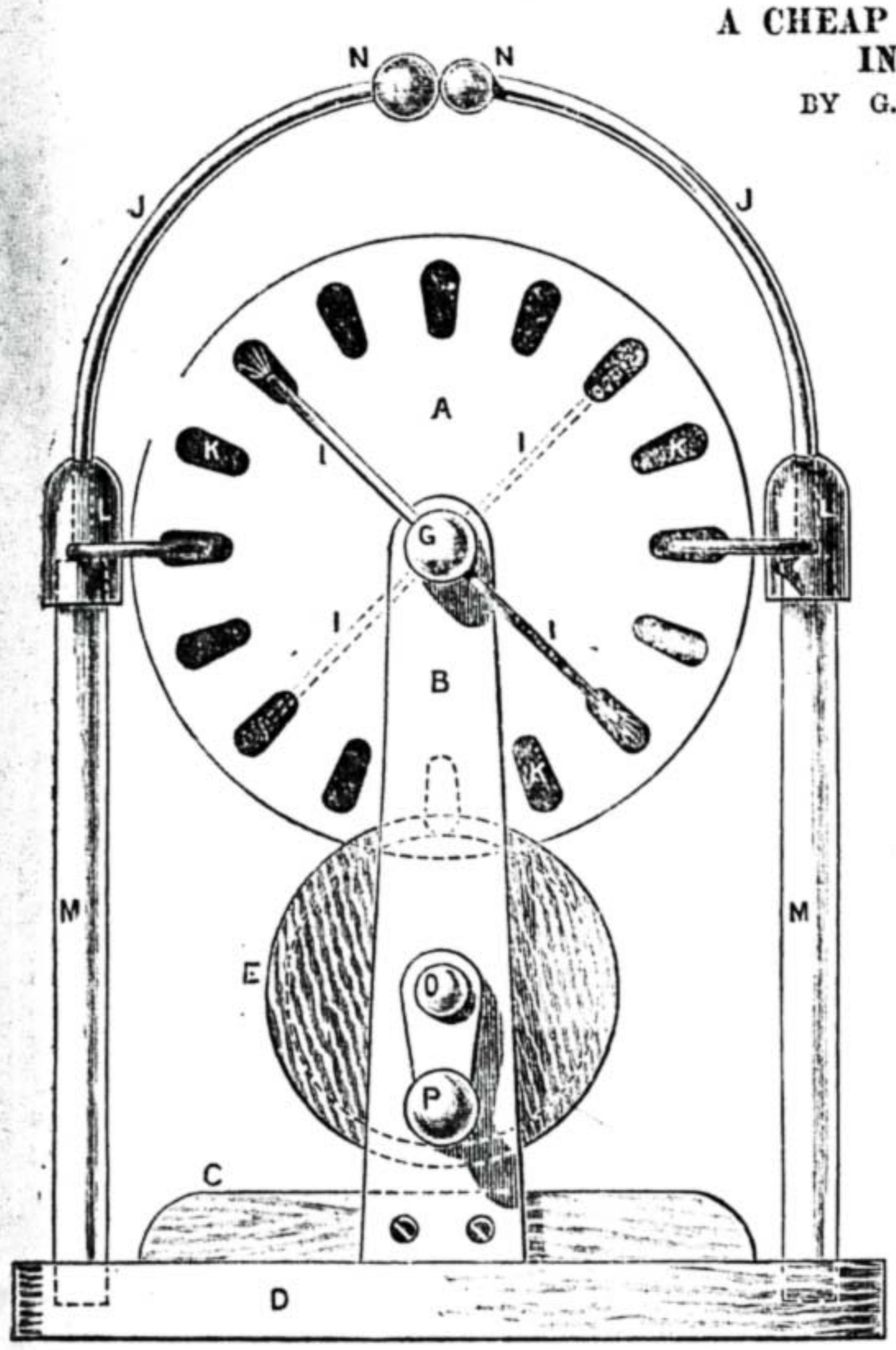

Fig. 1.—Cheap and Simple Electrical Induction Machine: front view.

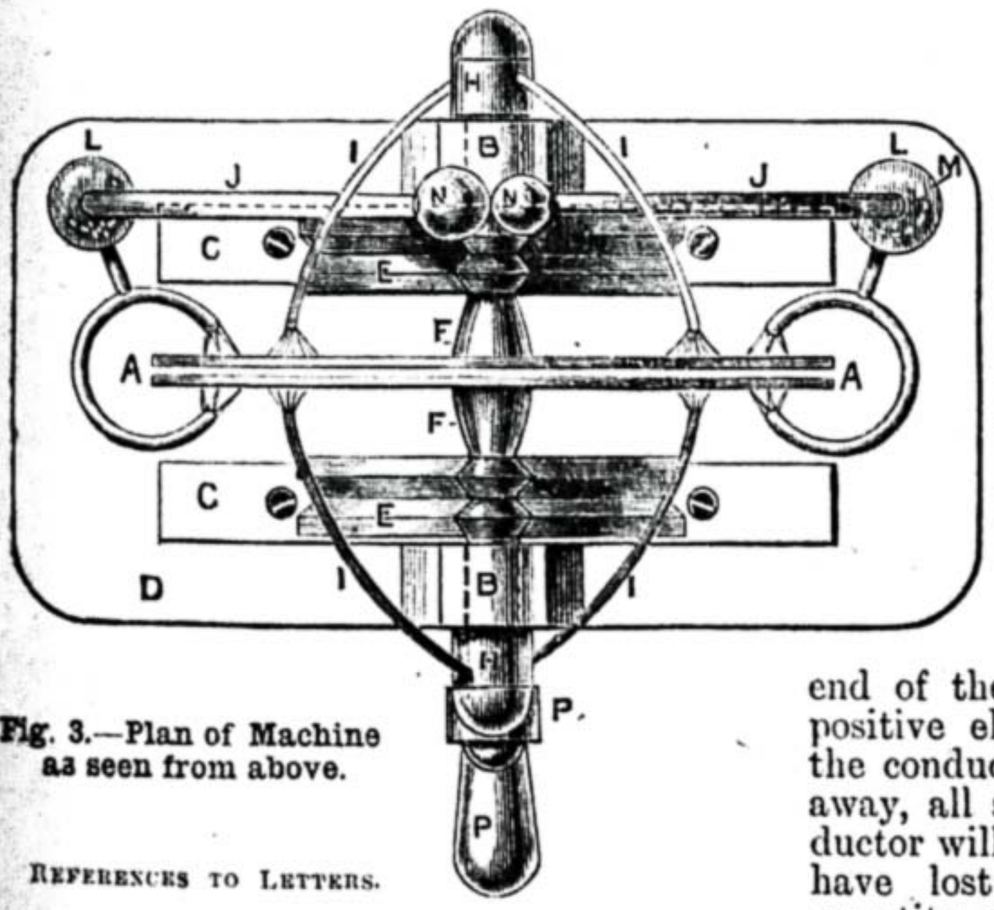

Fig. 3.—Plan of Machine as seen from above.

REFERENCES TO LETTERS.

A, Double Glass Plate: B, B, Supports; C, C, Slips screwed to Base; D, Base of Machine; E, E, Pulleys; F, F, Mahogany Bosses; G, G, Mahogany or Ebonite Brush-holders; H, H, Brass Tubes carrying Brushes; I, I, Brushes; J, J, Conductors;

THE construction and action of this machine is based on the fact (discovered in 1753 by John Canton) that when an electrified body is brought near an insulated conductor it causes an electrical separation to take place on that conductor. This action is called electrical induction. An experiment to illustrate this action can be made by rubbing a glass or ebonite rod with a silk or cotton handkerchief, and bringing it near to an insulated conductor, such as a metal pencil-case suspended by a silk thread. The ends of the conductor will then be found to attract such light bodies as feathers, chaff, or bits of paper; and if small balls of elder-pith or cork be hung to the ends, they will be repelled. It will be found that the middle portion of the conductor gives no sign of electrification, and that the electricity on the opposite ends are of different signs, that nearest the excited glass rod being negative, and that on the opposite end positive. It will thus be seen that a positively charged body induces negative electricity on the end of the conductor nearest to it, and positive electricity on the farthest end of the conductor. If the glass rod be taken away, all signs of electricity on the conductor will cease, while the glass rod will have lost some of its electricity. The quantity of the two charges induced on the conductor depends on the amount of charge on the rod (a highly charged rod

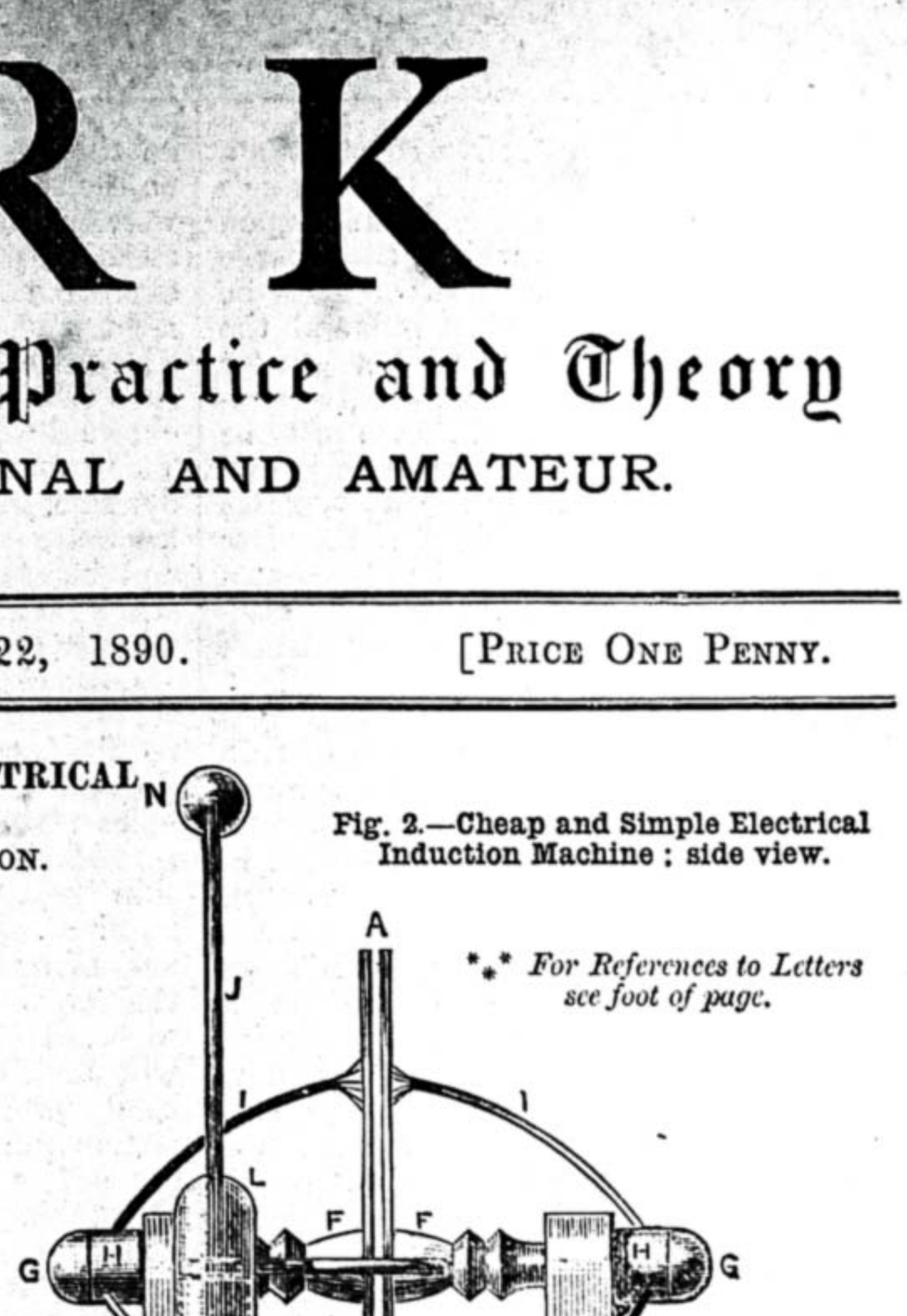

Fig. 2.—Cheap and Simple Electrical Induction Machine: side view.

*** *For References to Letters see foot of page.*

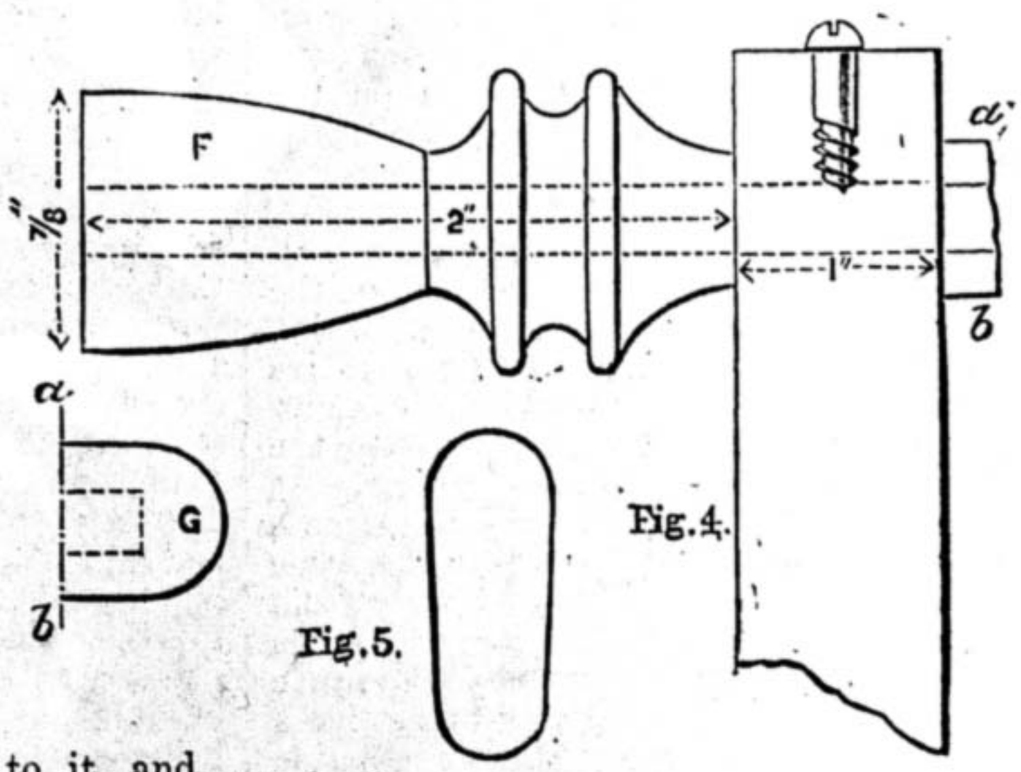

Fig. 4.—Mahogany Bosses: full size—G, Continuation of Fig. 4 at *a b*. Fig. 5.—Sector (full size).

REFERENCES TO LETTERS—*continued.*

K, K, Tinfoil Sectors; L, L, Mahogany or Ebonite Comb-holders; M, Collecting-comb Insulators; N, N, Brass Balls at Ends of Conductors; O, Spindle for Pulleys; P, Crank Handle.

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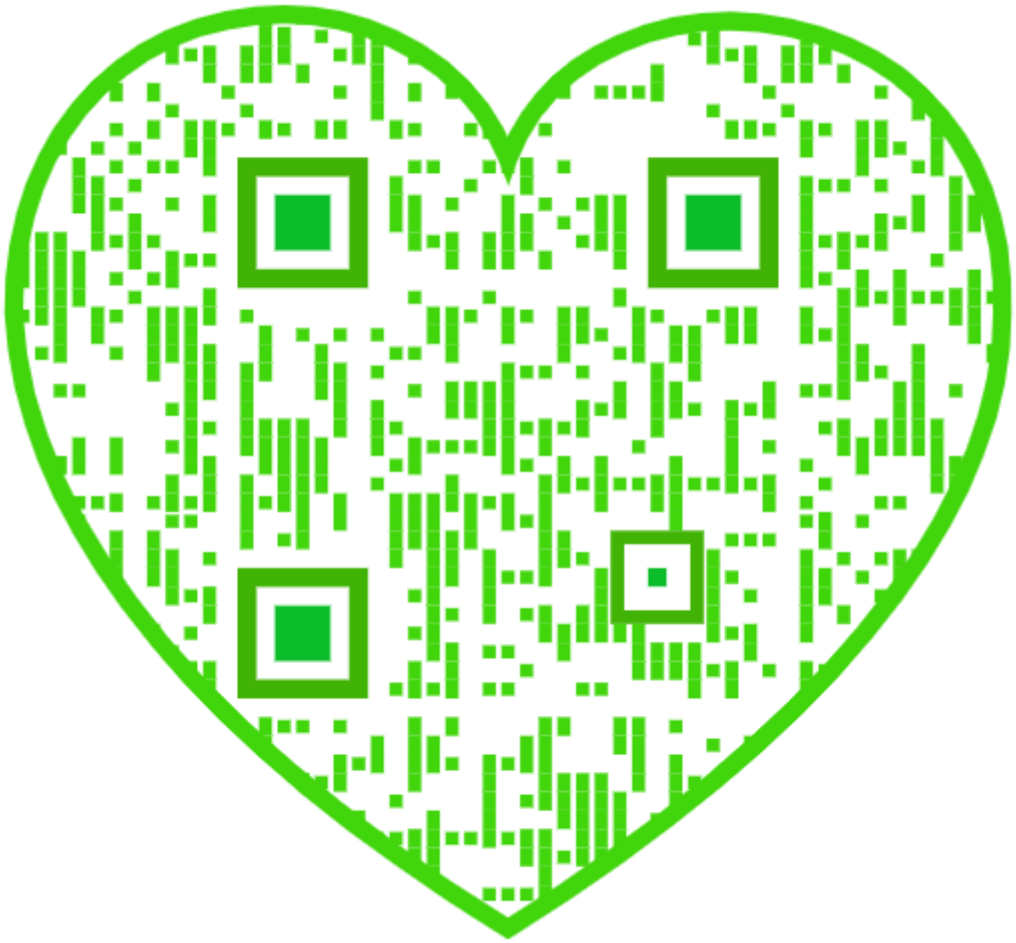

producing a greater inductive effect than a less highly charged one), upon the distance of the rod from the conductor, and upon the substance through which the charge acts. For instance, if a sheet of glass be introduced between the glass rod and the conductor it will be found that a greater amount of electricity is induced in the conductor. All these phenomena must be considered in the construction of an inductive electrical machine. If the glass plates of the machine be very thick, or if the glass be of bad quality, or if they be placed at a greater distance than $\frac{1}{8}$ in. apart, the electrical effect will be very much diminished, if not altogether stopped.

Description of the Machine.—This machine consists of two circular plates of thin window-glass, varnished with shellac varnish, and mounted upon a fixed metallic spindle in such a way that they can be rotated in opposite directions at a small distance apart. To each plate is attached sixteen sectors of tinfoil or thin brass at regular distances apart, and to the centres of each plate is cemented a hollow mahogany or ebonite boss, upon which is turned a small pulley. These are driven round by larger pulleys (fixed on to a spindle revolving in the lower part of the framework) by means of cords, one of which is crossed to get the necessary difference of rotation. Two curved metal rods, having small wire brushes soldered on to the ends, are fitted on to the ends of the fixed spindle. These brushes are capable of revolving round the spindle, and are best placed at about 45° from the horizontal diameter of the plates. These brushes momentarily touch two sectors on the same diameter of each plate as it revolves. Glass insulating rods, to which collecting combs and conductors are fitted, are fixed into the base of the machine. The points of these combs are directed towards and along the horizontal diameter of the plates. To the combs are fitted two brass or copper rods, terminating in balls, whose distance apart can be varied at will.

Action of the Machine.—The action of the machine may be briefly described as follows:—The glass plates, revolving at a high speed in opposite directions, are electrified by friction with the air, or some similar cause. This gives an initial charge to the sectors—some positively, and others negatively. If while the front plate is revolving from left to right the sector on the back plate, situated at about 45° from the horizontal diameter, and on the left of the plates, be charged positively, opposite to this sector there will be a sector on the front plate going from left to right. As it passes under the wire brush the positively electrified sector opposite, and on the back plate, causes an electrical separation to take place on it, attracting negative electricity, and repelling positive electricity through the brush and metallic rod to the opposite sector on the same diameter. As all the sectors on the top of the front plate pass this brush they receive a negative electric charge, and as they go over from left to right they influence the sectors on the back plate as they pass under the brush at the back, and cause them to receive a positive electric charge. The same action will necessarily take place on the bottom portions of the plates. As a result of these actions, positive electricity is brought over to the left side of both plates, while negative electricity is brought over to the right. If the front rod and brushes are revolved so that they are placed on the same diameter as the brushes on the back, and the brushes on the back are revolved so that they are on the same diameter as the front brushes were, the effects are reversed—that is, instead of positive electricity being brought over to the left, it is brought over to the right, and negative electricity to the left. The combs collect the electricity from each side of the plates, and conduct it to the external circuit through the brass balls. This machine is analogous to a shunt dynamo, in that it excites itself best when the external circuit is open, for if the combs and conductors be removed the machine still continues working, and begins to glow all over with brush discharges.

Construction of Machine.—To construct this machine two mahogany bosses are required of the shape and size shown in drawing (F, Fig. 4). They have $\frac{3}{16}$ in. or $\frac{1}{4}$ in. holes through their centres, and must be turned very true. Two circular plates of thin window-glass—8 in. diameter—are required. These should be of even thickness throughout, for if one side of a plate is thicker it will also be heavier, and when revolved at a high speed the heavier side will tend to fly off, causing vibration and most probably breakage of the plate. Before purchasing the plates it is best to get a few samples of glass, and test each by rubbing with silk and bringing near to bits of paper or any light substance, and selecting the glass which appears to be excited the easiest, and which attracts the paper the strongest. These plates usually have holes bored through their centres, but as glass boring is a difficult operation to inexperienced persons, I would recommend that they be mounted on the following method, by following which no holes are required:—On a sheet of paper or thin cardboard describe a circle having the same diameter as the plates. A smaller circle is described from the same centre, having the same diameter as the bosses. A glass plate is put on to the paper so that the edges of plate coincide with the outside circle, and the face of one of the bosses being covered with glue or similar cement, it is placed on to the plate so that the edges coincide with the outside of the smaller circle. It should then be gently pressed, and the cement removed with a wet sponge. The plate should then be removed, and put aside until dry. The same operation is gone through with the second plate. On to the centre of the back of one of the plates (A) a cardboard washer about $\frac{1}{16}$ inch thick should be glued, to keep the plates the necessary distance apart. While the plates are drying the base (D) and supports (B) should be constructed. These are made of 1 in. mahogany or pine. The dimensions of the base are 12 in. by 6 in. The supports (B) are 2 in. at base, tapering to 1 in. at top by 10 in. in length. They are to be glued and screwed on to two slips (C) of mahogany or pine—1 in. by 1 in. by 8 in.—which are screwed on to the base (D). The holes for the boss (F) and pulley spindles should be quite parallel, and are best done by clamping the supports together and drilling them. The large pulleys (E) are of mahogany or pine, $4\frac{1}{2}$ in. diameter and $\frac{1}{2}$ in. in thickness. After being roughly turned to size, they should be glued the correct distance apart on to the spindle (O), which is $\frac{1}{2}$ in. square by 7 in. in length, of mahogany or other hard wood, and put between lathe centres and turned to correct size. The spindle is turned circular for 1 in. from one end and 2 in. from the other end. To this end a crank and handle is fitted, as shown (Figs. 1, 2, and 3, P). One of the supports should be permanently fixed with screws, and glued on to the base; the other should be loose, to allow of adjusting the plates. If the glass plates have holes bored in centres, a $\frac{3}{16}$ in. or $\frac{1}{4}$ in. spindle will have to be passed through the plates and supports; if the plates are mounted in the manner I recommend, two short spindles should be used. One should be fitted into each support, and should project about one inch on the outside of support, and about two inches on the inside of support, and they should be a tight fit. On to the projecting ends of the spindles a brush-holder (G) of mahogany or ebonite should be fitted. These are to carry the neutralising rods and brushes (I), which are of $\frac{1}{8}$ in. brass or copper wire, soldered into short pieces of brass tube (H), so as to revolve stiffly. On to the ends of the rods are soldered small brushes made of very thin copper, or brass foil or wire. The collecting-comb insulators (M) are of $\frac{1}{2}$ in. glass tube. On to one end of each tube a brass, ebonite, or mahogany comb-holder (L) is fitted, and the other end of the tubes should be cemented into holes bored in the base. The combs (I) are of $\frac{1}{8}$ in. brass or copper wire, shaped as in drawing, with common pins soldered on to the ends. Holes are drilled in the comb-holders (L), into which the combs fit tightly. The conductors (J), which are of $\frac{3}{16}$ in. brass or copper rod, should fit into holes drilled into the top of comb-holders (L). They should make electrical connection with the comb-holder, and should terminate in brass balls (N)—one about $\frac{3}{4}$ in., the other about $\frac{1}{2}$ in., diameter. The base, supports, and pulleys being put together, the glass plates should now be varnished with thin shellac varnish, which is made by dissolving orange or button shellac in methylated spirit. The plates before being varnished must be heated before a fire, which is best done by holding the plate on a bit of thick wire, and revolving it by gently striking it with the finger, or, if the frame of the machine is not polished, the plate may be mounted and driven round by means of the handle. The plate must not be allowed to get very hot; it should be just hot enough to allow the back of the finger being placed against it It should then be removed from the fire, and if it has been heated on a bit of wire it should be mounted in the frame. A large camel-hair brush should then be dipped into the thin shellac varnish and applied to the plate, which should be rapidly revolved by means of the handle and pulleys. Both plates should be varnished until they appear of a pale yellow colour. If the varnish has a milky appearance while being applied it shows that the plate is not hot enough, and therefore it should be heated again. I would advise that a few trials be made on a piece of glass until the necessary experience and skill are gained, it being a difficult matter to varnish properly. After the plates are varnished the tinfoil sectors should be fixed on to them at regular distances apart. This is done by means of a template, which can be made by taking the card used for fixing the bosses on to the plates, and drawing a circle $\frac{3}{8}$ in. inside the outside circle, and another about 1 in. from the second. The second circle is divided into sixteen parts, and the sectors are drawn full size, as shown (Fig. 1). The sectors are made by cutting a card into shapes shown full size in Fig. 5. A strip of thin tinfoil, rather larger than the full-size sector, is folded up into sixteen folds, and the shape being placed on to the tinfoil, the required number of sectors are cut out

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at once by cutting round the shape with sharp scissors. The plates are then put on to the template, and the sectors are stuck on with gum or other cement, as shown (Fig. 1). The plates on drying should be washed to get rid of any gum which may remain, and they can then be mounted on to the frame, which should be polished or varnished. The plates should be adjusted until quite parallel by moving the loose support about until the right position is found, when the support should be fixed into the base with brass screws. The plates should revolve about $\frac{1}{16}$ in. apart. One or two Leyden jars should be connected to the combs to get the best effect from the machine. These are made of thin glass jars, or large test tubes coated outside and inside with thin tinfoil or bronze powder cemented on to the glass with gum. The metallic coating should reach to about 4 in. of the top of jars. A large cork, or cover of mahogany soaked in melted paraffin wax, should be fitted on to the top of the jar, and a $\frac{1}{8}$ in. brass rod, terminating in a brass ball, should be passed through until the end of the rod touches the bottom of the jar. If one jar is used it must be insulated from the earth by means of a large glass plate; if two jars are used they need not be insulated, but both the outer coatings should be connected by a strip of tinfoil, and the inside coatings connected to the separate conductors. It is best to varnish the tops of the jars in the same manner as the plates were varnished, to prevent any loss of electricity. The frame should be either varnished or polished, and should be free from sharp corners or points. In starting the machine, it is best to keep the conductors apart until the machine excites itself. The conductors can then be brought together until the spark passes.

PARAFFIN LAMPS.

BY THOMASO.

PATTERN FOR BASE OF STAND—HANDLE—SLIDING PIECE—SET-SCREWS—MAKING STAND—RESERVOIR—TUBE FOR BOTTOM SLIDING PIECE—FINISHING OFF ENDS—FINISHING OF LAMP—LACQUERING AND FINISHING BASE.

WE will start on the pattern for the base of the stand. From Fig. 5 and the section Fig. 6 all dimensions can be got. The measurements of Fig. 5 are taken before bevelling the edges, and the section is taken at A B, Fig. 5. I made my pattern of pine, cutting it out first as shown by the dotted lines on the section, and then gluing and nailing on the flanges of the shape, also shown by the dotted lines. The two could then be bevelled off at one operation. The semicircular part of the flange I cut out with a fret saw, and bevelled with a sharp penknife. If you have a fret-sawing machine with a tilting table, there is no difficulty; but do not bevel the outside until it is in position. The ring x in Figs. 5 and 6 I cut out of a piece of $\frac{1}{8}$ in. walnut, such as is sold for fretwork, and then rounded it with a penknife and file very gingerly. The centre-piece c (Figs. 5 and 6) was also bevelled with a knife, and glued on after the hole underneath it had been made and bevelled. Be sure and see that the pattern stands flat and does not "wobble," or you will have trouble with the casting. Of course, I am going on the assumption that you are in the same position as myself—viz., latheless.

The next pattern will be for the handle, shown full size at Fig. 7. I cut my pattern out of a solid piece of beech, but an easier way, and one which I have since adopted in other patterns of a fragile nature, is by gluing two pieces of fretwood (say $\frac{1}{8}$ in. walnut) together, the grain of one piece being at right angles to that of the other. Trace the outline of the handle on the piece of wood thus prepared, and saw it to shape with a fret saw. Small pieces of soft wood can then be glued on each side to form the round part at the bottom, and the whole finished off.

The next pattern is for the sliding piece s (Fig. 1, p. 480), shown full size in Figs. 8 and 9. It might be made of pine, with the grain running in the direction of its greatest length. The radius of the curved part is, of course, half the diameter of the shade, whatever that may be, plus the thickness of the brass rim supporting the shade ($\frac{1}{16}$ in.). As illustrated, it is for a $7\frac{1}{4}$ in. shade. Better have it a little larger than otherwise.

One more pattern is required (Fig. 10). This is simply five pieces of wood "skewered," and secured with a touch of glue. Numbers 1 to 5 give the respective shapes of the pieces, and the numbers correspond. Divided where indicated by the arrows, you get the two set-screws, the lower sliding piece T (Fig. 1, p. 480), and two other pieces for a nut and a washer.

Smooth all the patterns, and give them two or three coats of varnish made with methylated spirit and orange shellac crushed up fine. This will take a day or two to dissolve, and must be stirred frequently. Go over the patterns with fine sand-paper after varnishing.

The price charged me for a casting of the pattern of the base (weighing 3 lbs.) was $7\frac{1}{2}$d. The remainder of the castings (brass) cost about 6d. It saves trouble, when the castings are small and various, to take a rough sketch of each with you when you go to get them. The founder can then see at once what the pattern is like.

Having got the castings, you can start on the stand. Take the $\frac{9}{16}$ in. square brass wire, which is for the upright, and cut it 17 in. long. It is best to get it a little longer than you actually want, as the ends are generally mangled in the cutting. Straighten it carefully, using a mallet. A hammer can be used if something is kept between it and the brass to prevent indenting. File $\frac{3}{4}$ in. of each end round, and cut a $\frac{1}{4}$ in. screw-thread on them. A screw-plate will be wanted for the set-screws, $\frac{5}{32}$ in. being about the size for them. Drill and tap the iron base to fit the upright. Drill and tap the square piece cast on the "skewer," to form the nut z (Fig. 6), and file up, bevel, drill, and slightly countersink the octagonal piece for the washer w (Fig. 6). Drill and tap the handle to fit the other end of the upright, and then file it up. It being screwed on the upright will render this easier. If the end of the upright should project through the handle, file it even. File up the top sliding piece, and drill and square the hole with a square file, where indicated by the dotted lines in Fig. 8, to fit the upright easily, and drill and tap the hole for the set-screw where shown. If you have to get the screw-threads cut for you have them done before finishing up the metal, and let the man drill the necessary holes for the screws. Now take the $1\frac{1}{2}$ in. by $\frac{1}{16}$ in. flat wire, and bend it with your fingers into a ring large enough to take the rim of the shade easily, and rivet (copper rivets) or screw the ends to the sliding piece as shown. If you taper the holes for the rivets slightly, you will be able to file the ends off flush. Before riveting, see that the ring touches all round when laid on a flat surface, or the shade will chatter with every movement in the room.

The reservoir is the next thing to be made. Two pieces of the sheet brass shaped like Fig. 11 are required. The diagram shows the radii of the circles. The distance of the centres of the circles one from another must be got in this manner:—Temporarily fit the stand together (a bed-key is just the thing for tightening the nut under the base), and put the shade in position. Then measure from the centre of the upright to the centre of the opening in the top of the shade. This is the distance required. It is important that the chimney should come in the centre of the shade, because if it touches, one or the other will most likely crack. The piece for the bottom is to be $\frac{1}{8}$ in. smaller all round than the top. Lay the bottom on the top, and mark round it with a sharp point. This mark is for a guide in soldering the sides on. The larger of the two holes in the top must be large enough for the screw collar of the burner to need a little coaxing to get it in. Allow it to project through about $\frac{1}{16}$ in., and then solder it. Before soldering, see that when the burner is screwed in the milled head of the winder comes to the side, so that it can be conveniently turned by the right hand. The other hole in the top (which must come exactly over that in the bottom) is to take the tube holding the bottom sliding piece. The tube can be bought at the metal warehouse or made out of the sheet brass, about 4 in. long. When in position it should project through the bottom about $\frac{1}{8}$ in., and about 1 in. above the top. Solder the joint (a lap one) very carefully, as you will not be able to get at it if it should leak. The part of the join which shows above the top of the cistern should alone be filed even. Drill and square the hole in the bottom sliding piece, file it up roughly, slip it in the top of the tube until it (the tube) is about $\frac{1}{16}$ in. above it, and then solder it, using a very hot iron Keep the iron on the solder until the brass is thoroughly hot, and the solder keeps melted for a second or two after taking the iron away, and you will get a strong join. The join in the tube will most likely want re-soldering after this. With a centre-punch dint the tube in three or four places round the sliding piece, in the same manner as the brass ferrules are fastened on tool handles. This will securely hold the sliding piece in case the solder has not united the parts properly. File the top of the tube level, and fit the set-screw on the side opposite to the join in the tube. These set-screws (Fig. 10) should be notched round the edge with a file after the thread is cut—that is, if they are not turned and milled. You can now cut the holes in the top and bottom of the cistern the right size for the tube. In cutting holes in sheet metal I always use a fine fret saw, to prevent the metal buckling. The piece to form the sides is 3 in. wide. The length you get by measuring round the bottom piece of the cistern with a strip of paper, allowing $\frac{1}{2}$ in. or so extra. See that the edges are straight and square, then mark the middle; bend it to something near the shape, and putting it upon the under side of the top piece, with the centre mark in the middle of what will be the front of the lamp, solder it to the line you marked, leaving about 3 in. of each end unsoldered for the present. Be careful that the sides are at right angles to the top, as they are rather apt to get a twist.

Most people tin brass before soldering. I am not one of the "most people." With a

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hot iron and killed acid I never have any difficulty in making a strong job of any brass-work of a reasonable size.

Put the tube carrying the bottom sliding piece in position, and then just slip the bottom of the cistern in place, and try it on the stand. See that the upright *is* upright—the T square will tell you—and that the shade-holder, when fastened in position, does not overhang one side of the iron base more than the other. It can be regulated by filing a little off the side of the square hole in the sliding piece opposite to the set-screw; but do not do this until you are sure that the fault does not lay with the upright. It may have got a twist.

Having got all even, secure the tube with a couple of dots of solder on the outside, just to hold it in position while it is being properly soldered (you can scrape them off after), and then solder it in firmly, the ends of the sides being left unsoldered rendering it easier. If the end of the bit is curved with a hammer while hot, it will also assist.

The ends can now be finished. Trim them down, an equal amount off each, until the two edges will meet in the centre of the back of the reservoir, at right angles to the top. Finish soldering them, and then solder the join inside, making the solder flow about half an inch on each side of it. Cut a piece of the sheet brass, 3 in. by ½ in., coat it thickly on one side with solder, put some killed acid on it and the join, lay the soldered side down on the join, and press a hot soldering iron on it—the hotter the better. The solder between will melt, and the join be as strong as if it was lapped. Solder carefully down the sides of the strip, fill up the crack outside with solder, and go over every doubtful place, especially where there appears to be only a thin film of solder, and then solder the bottom in, about ⅛ in. from the edge. The bottom should slip in easily and fit well. If force has to be used to get it in, the reservoir will get bent out of shape. The end of the tube will, or should, project slightly beyond it. Cut a piece of the sheet brass; in the middle cut a square hole to fit the upright; slip it on, screw the cistern in position, and solder the piece over the bottom of the tube. This will take a good deal of the strain off the set-screw, and prevent it marking the upright to a great extent. It is best to file a little off the sides of the square holes where the set-screws are, and then insert a thin piece of sheet metal, bent as shown in Figs. 8 and 9. These pieces cannot come out unless the parts are taken right off the upright, and they prevent the screw marking it. There is no need to screw up the set-screws as if they were never going to be undone again. A very little force is sufficient.

The lamp can now be finished off. Polish up the reservoir first with emery-cloth or fine sand-paper, and then with (say) Bath brick, being careful to rub in one direction, and not with a circular scrubbing motion. This is all the cistern wants, as the paraffin will keep the brass bright if it is rubbed with the duster after filling. Fine-file the upright in the direction of its length, polish with fine emery-cloth, and burnish. As it comes from the shop it is fairly smooth, though dirty. Scraping with a steel scraper previous to burnishing is a safer and quicker method for amateurs than filing. The upright should be finished before it is finally screwed into the base, care being taken that the vice does not mark it. Burnish the handle, top sliding piece, and outside of set-screws. Polish the shade-holder, and burnish the edges. The varnish I have mentioned for the patterns makes very good lacquer. With a camel-hair brush varnish the shade-holder, top sliding piece, set-screw heads, handle, and the little washer at the bottom of the upright. This being only a rough sort of lacquering, I held the pieces over the top of the lamp, moving them about until the steamy look had gone off. The result was quite satisfactory. Before lacquering, see that the articles are free from dirt and finger-marks.

The base I finished by mixing some powder colour (dark Quaker green looks well) with gold size, and painting it over. When dry, I gave it two or three coats of the spirit varnish and stood it with the back to the fire, to harden the varnish until it was as hot as I could bear standing on my hand. The result was equal to Japan, and, what is of more importance, paraffin does not affect it. Avoid Brunswick black; paraffin will bring it all off wherever it touches. Any ornamentation in the way of lines, etc., should be put on before the last coat of varnish.

When the base is cold, quickly paint the edges with the varnish (liquid glue would be better), and stand the whole concern on a piece of green baize (I used black cloth). When the varnish or glue is hard, cut the baize round with a sharp knife, and the lamp is finished.

When taking the chimney off, take hold of it by the thickest part down by the burner, or it might break off short at the neck. When carrying the lamp about, take hold of the upright just under the handle, the latter only being intended to prevent your hand slipping, and to give a finished appearance. The lamp would not hang unevenly anything to signify; but unless you had a full thread cut on the top of the upright and in the handle, it would scarcely be safe to swing it. And as the handle, as I have just said, is rather ornamental than useful, except as a means to prevent slipping, it is open to the maker to substitute a knob for the handle shown, if he thinks it to be preferable.

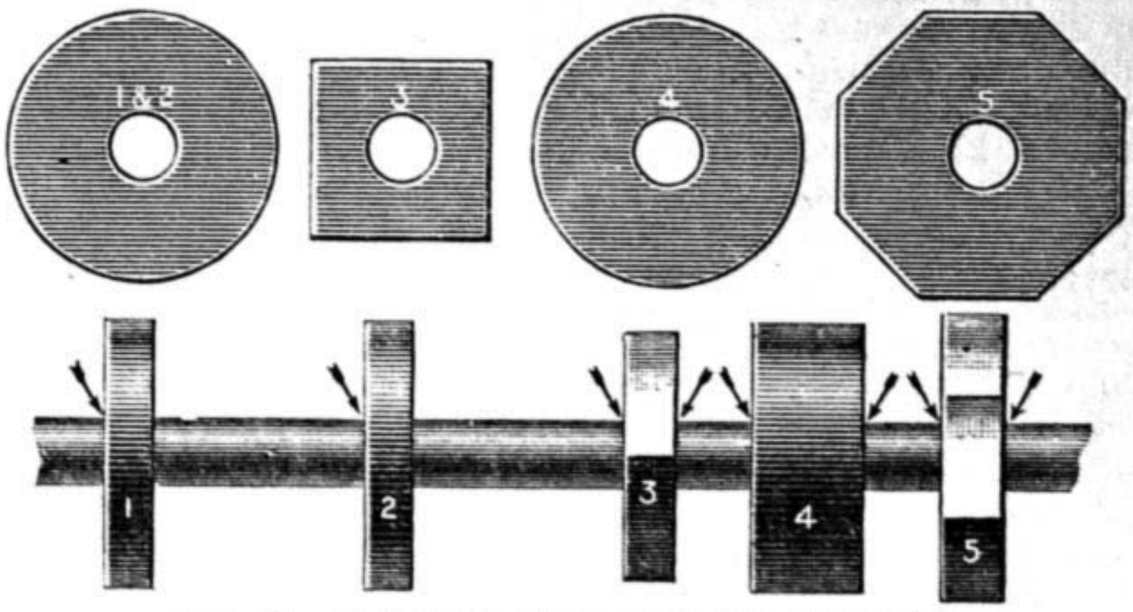

Fig. 10.—Pattern for Set-screws, etc. (full size).

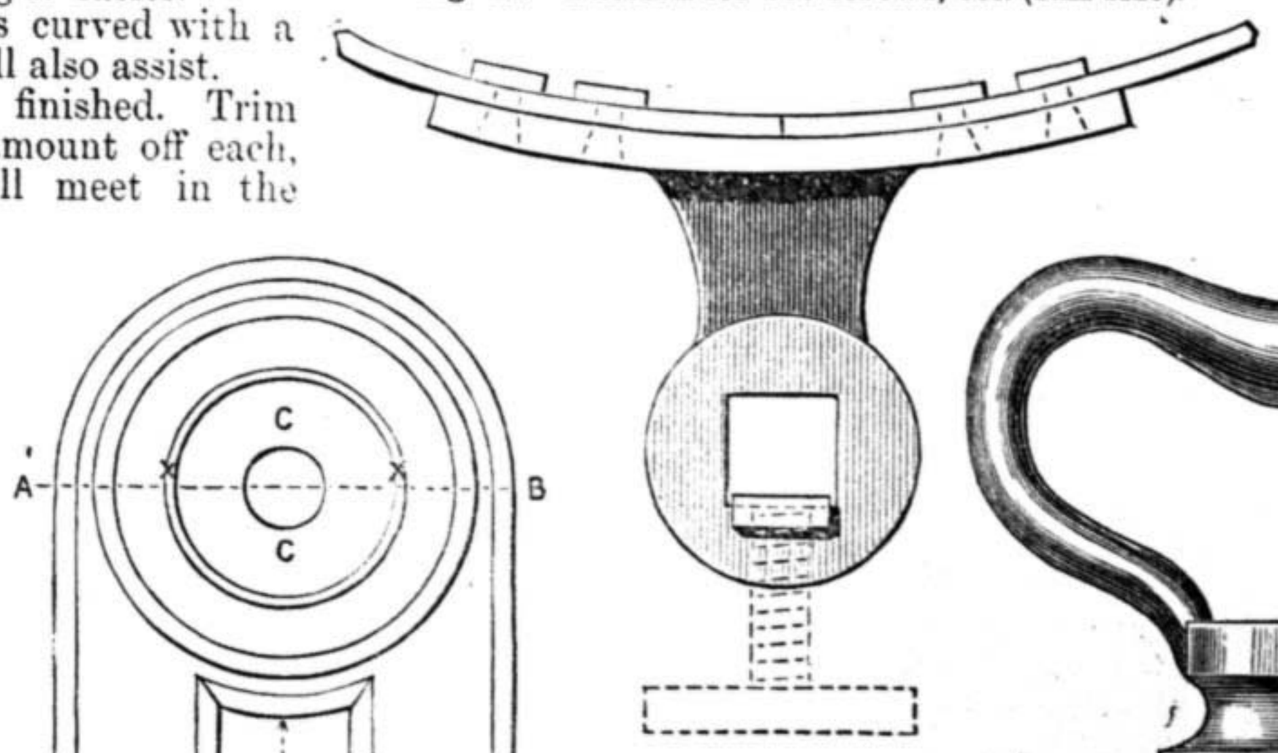

Fig. 5.—Plan of Base.

Fig. 8.—Top Sliding Piece (full size).

Fig. 7.—Handle (full size).

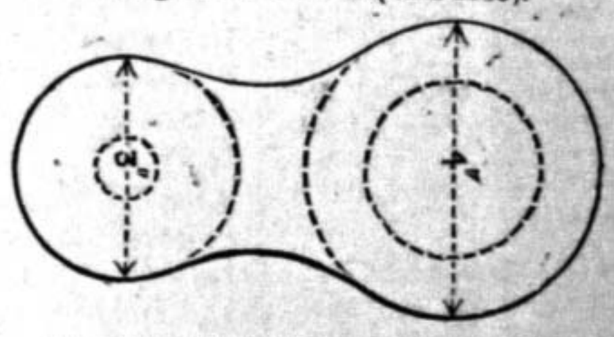

Fig. 11.—Top and Bottom of Cistern.

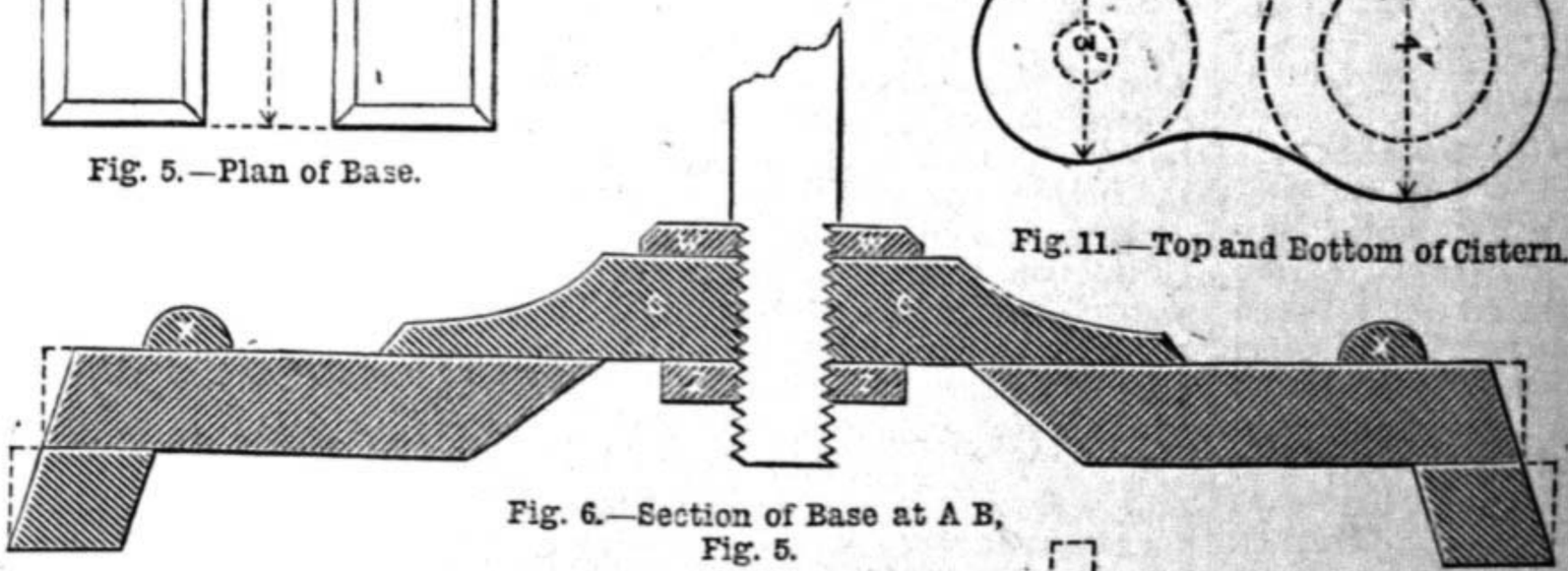

Fig. 6.—Section of Base at A B, Fig. 5.

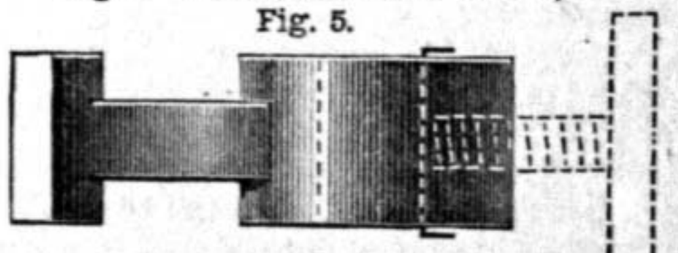

Fig. 9.—Top Sliding Piece, side view (full size).

HIVES AND OTHER APIARIAN APPLIANCES.

BY APIS.

WAX EXTRACTORS—THE SOLAR EXTRACTOR—GERSTER'S EXTRACTOR.

WAX extractors follow honey extractors in a natural sequence, although, perhaps, not as indispensable to the welfare of an apiary. A good deal of extracting can be done with very simple apparatus; for instance, I was satisfied for a long time with an extractor

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which was made thus: An ordinary milk strainer, with fine wire netting for the bottom, was bought for eightpence. It is almost eight inches across, and has sloping sides a couple of inches high. A saucepan was then borrowed in the kitchen into which the lower part of the strainer would fit, and be supported by the rim round the edge. Water was put in the saucepan, the strainer over, the combs in the strainer, and the saucepan cover fitted the top of the strainer.

The whole was then put on the range, where the water was brought to the boil; the steam rose through the strainer, and melted the wax, which passed through to the water underneath, leaving any dirt or refuse in the strainer. When all the wax was extracted, the water was poured into a basin, and the wax, when cool, was found in a cake on top.

This is very simple and inexpensive, and is on the same principle as the Gerster Extractor, except that, in the latter, the wax is not brought into contact with boiling water.

The Solar Extractor takes the palm for the quality of the wax extracted by it. It can be used only in the summer when the sun is hot, but then it works of itself, and costs nothing.

It is a well-known physical fact that glass is a trap for heat—that is, it lets it in, but will not let it out again. To be more exact, it permits of the passage of luminous rays of heat, but not of opaque. The direct rays of the sun are luminous, but those which are radiated from a comparatively dull substance are opaque. For instance, in a greenhouse, we find the heat very much more oppressive than in the hottest place outside.

This principle is utilised in the Solar Extractor. It consists of a box formed with a sloping top like a desk, which top is glazed with a double thickness of glass as is seen in Fig. 5. The dimensions may vary considerably, but those I have given in Fig. 1 will make a very useful and practicable size, viz., length, 20 in.; breadth, 12 in.; height at back, 12 in.; at front, 6 in. It should be made of very sound and dry stuff, preferably yellow pine, and it would be well to dovetail it together at the corners. The bottom should be grooved and tongued at the joint, or else made of one piece of wood. It would be a great improvement to line the whole structure with tin, which would ensure its being tight. The top consists of a frame of 2 in. × 1 in. stuff morticed together at the corners, and rebated to take the glass, the rebate being ¾ in. × ¼ in. The glass is to be placed in a bedding of soft putty—a very thin coat—then a strip ⅝ in. × ¼ in. is to be tacked to the frame close up to the glass; the other glass is then to be put in a similar bedding of putty, and another strip tacked on over all. The object is to have the glass air-tight in the frame, and this can easily be secured by a judicious use of putty or white lead. The frame may now be attached to the box by means of a couple of hinges at the back, and two hooks in front will keep it down close.

A tin shelf is now to be made, the length of the inside, and approaching within an inch or so of the front. Three sides of this shelf, or rather tray, are to be turned up an inch, and the corners to get a touch of solder. Supports are now to be affixed to the inside to support the tray. If the box is lined with tin, these supports would take the form of pieces of tin soldered against the ends, and turned up at right angles, like L iron. If, however, the extractor is not lined, strips of wood tacked against the ends would do. The tray is to slope slightly forward so that the wax will run into the receptacle placed in front for it. The strips which support it will be placed about half-way up the ends. Over the tray there is a sieve of tinned wire netting, bound with tin, on which the combs to be converted into wax are placed. This sieve is a quarter of an inch from the tray, supported with strips of tin standing edgeways across it. I also have the tinned edges turned up for a quarter of an inch, so as to catch the comb and prevent it from slipping off.

The box to catch the wax underneath is as long as will fit between the tray supports, and may be as wide as the extractor, or any less width. It is made of tin with a wired top, and is, of course, water and wax-tight. Care should be taken that the fluid wax will all flow into the receptacle placed for it, and not flow over its ends where it is not wanted.

A convenient stand for this extractor is shown in Figs. 2, 3, 4. To make Fig. 2, get two pieces of wood 2 ft. long by 2 in. square, and halve them together in the middle. Now get another piece 15 in. long by 3 in. square, and round the upper end for a distance of about 3 in. to 1½ in. diameter; then cut the lower part to fit over the junction of the cross pieces, and affix it to them with one long spike driven from underneath, and some smaller nails at the sides, having it at right angles to the cross pieces. Fig. 3 may next be taken in hand; it may be any convenient size, and about 3 in. thick. The most important item in its construction is the boring of the hole, which is 1½ in. diameter, and should be exactly at right angles to the upper surface. It is countersunk on top, so that the washer and screw (Fig. 4) will be flush, or, if anything,

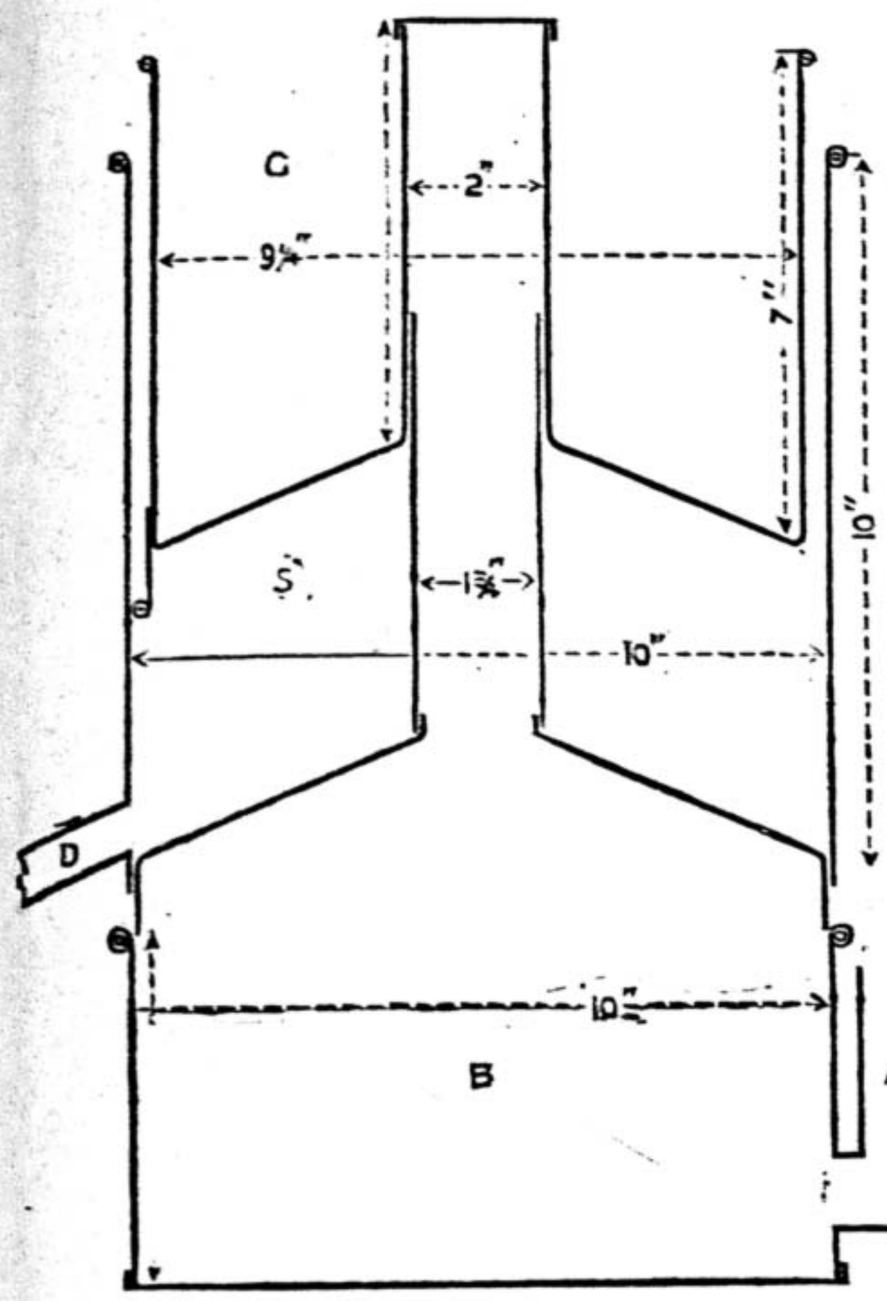

Fig. 6.

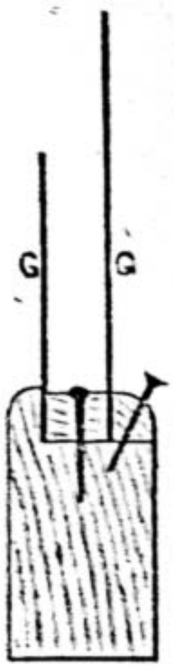

Fig. 5.

Fig. 3.

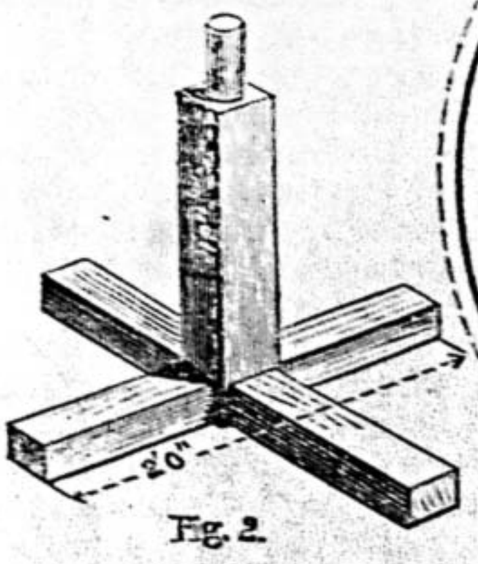

Fig. 2.

Fig. 4.

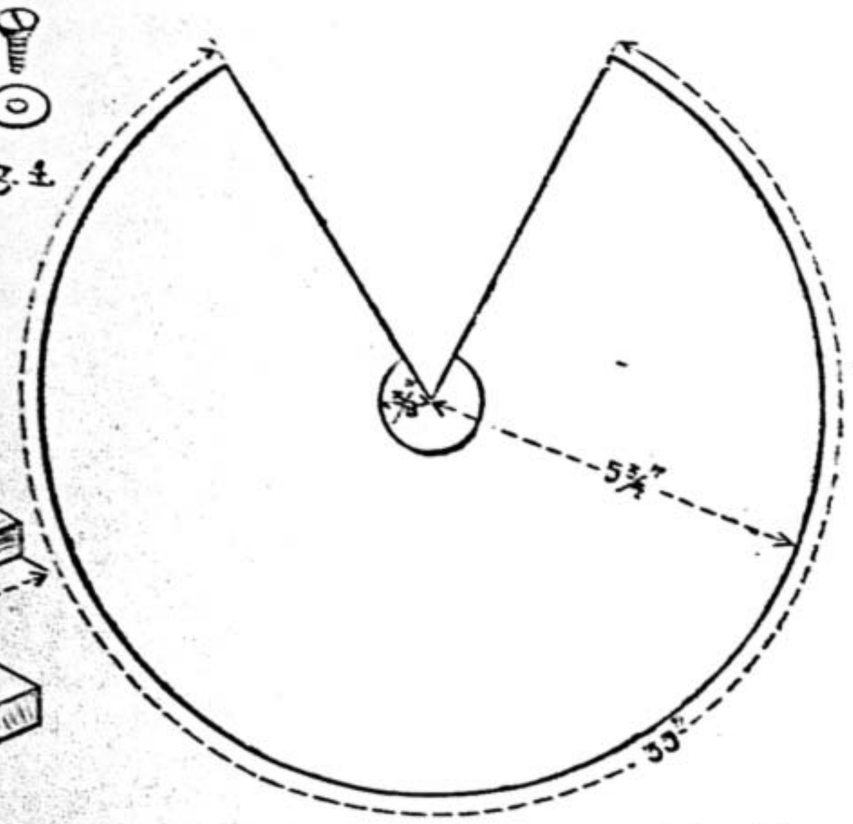

Fig. 7.

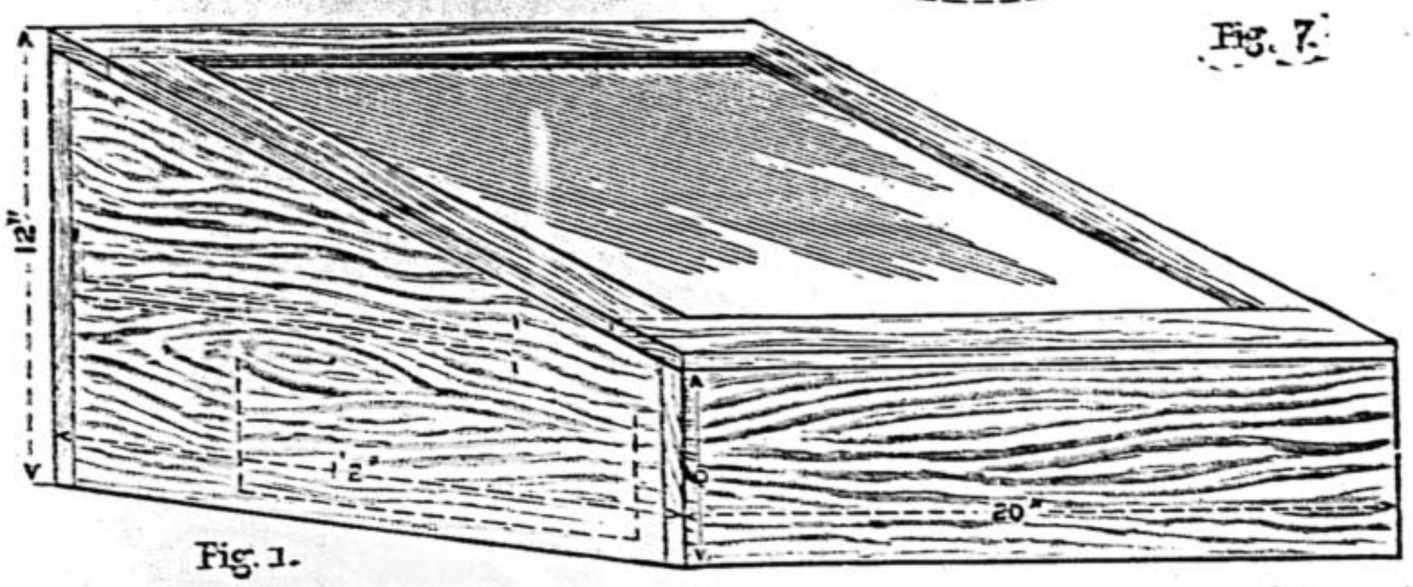

Fig. 1.

Fig. 1.—Solar Extractor. Fig. 2.—Foot of Stand for Solar Extractor. Fig. 3.—Revolving Top, fitting on Foot of Stand. Fig. 4.—Washer and Screw to secure Top of Stand to Foot. Fig. 5.—Mode of glazing Top of Solar Extractor—G, Glass. Fig. 6.—Section of the Gerster Extractor—B, Boiler; S, Steamer; C, Comb Basket; A, D, Pipes. Fig. 7.—Mode of cutting Cylindrical Top of Boiler.

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somewhat lower than the surface of the wood. When the entire stand is together, the extractor can be attached to it by means of four screws passing upwards into the bottom. The object of the revolving part is, I need scarcely say, to enable the glass top to be turned, so as to catch the direct rays of the sun.

I now turn to the Gerster Extractor, of which a section is given in Fig. 6.

It consists of four parts: 1, the boiler; 2, the steamer; 3, the comb basket; 4, the cover, or lid. Of all tin work I dislike most the making of covers. It is hard to dish them to a nice curve without special tools and blocks; and, consequently, I usually buy a saucepan cover for a few pence at the ironmonger's, and make the other parts of any piece of apparatus to suit the cover. Supposing, then, that the cover is 10 in. across, the boiler and steamer will be the same size.

The former can first be taken in hand. It would be advisable to make it of copper, as it would be then far more lasting. If, however, tin is used, on no account should acid be employed as a flux for the solder, as it would soon eat its way through the plates.

The boiler may vary much in height, but 5 in., shown in Fig. 6, will suit very well. The pipe A requires a word of explanation. Its object is to allow the height of the water in the boiler to be seen without taking off the steamer, which would be an awkward thing to do often.

This pipe would be about an inch in diameter, and have a cork or metal cap to cover the top. Instead of it a U-shaped piece of tin could be soldered over the hole in the boiler, and would be equally efficacious.

The steamer is of the same external diameter as the boiler. The bottom is in the form of a cone, of which a pattern is given in Fig. 7, and a rim of doubled tin is affixed to the lower edge, small enough to fit into the boiler. It is made just in the same manner as an ordinary vegetable steamer, which will be a good guide in its manufacture. The apex of the coned bottom has a hole cut out of it, the edge is slightly turned up, and a $1\frac{3}{4}$ in. tin tube, 6 in. long, is soldered firmly to it. Another tube, D, is soldered into the side, as low down as possible, so that it will drain out all the contents of the steamer.

The comb basket is made of perforated tin, one hundred holes to the inch, which can be procured from Messrs. Abbott, 9, Merchants' Quay, Dublin, at one shilling a sheet, measuring 20 in. × 14 in. The cylindrical part, $9\frac{1}{4}$ in. diameter and 7 in. high, can first be made.

It may be necessary to give a rule for cutting out the material for making hollow cylinders such as this: Multiply the diameter by $3\frac{1}{7}$, and add what is required to make the joint. If a plain overlapping joint is used, add the amount of lap; but if a hooked joint, such as I recommend, is used, three times the length of the turned over parts should be added, usually about $\frac{3}{4}$ in.

In the present case, a strip of perforated tin, $29\frac{1}{4}$ in. × $7\frac{5}{8}$ in., will form the cylinder, the extra width being $\frac{3}{8}$ in. for the wiring on top, and $\frac{1}{4}$ in. to make the joint at the bottom.

The conical bottom of the basket has the same slope as that of the steamer; the same pattern will do for both, except that the radius of the basket pattern may be $\frac{3}{8}$ in. less. A perforated tin tube, similar to that in steamer, but $\frac{1}{4}$ in. larger, is fixed in the centre of the comb basket; but, while the tube in steamer is open at both ends, that in the basket is closed on top with a piece of plain tin—the cover of a coffee canister does capitally.

Three legs made of doubled tin are soldered, equidistant from each other, to the lower edges of the comb basket, so as to keep the bottom an inch from that of the steamer. In Fig. 6 I have drawn the three parts separated from each other, but they would fit down into place in actual use.

To use this extractor, water is placed in the boiler, which is then placed on the range or on a fire; the combs are smashed up and put in the comb basket, which is put into place, and the cover fits over all, and keeps in the steam. Presently, when the water begins to boil, the steam passes up through the centre tube of the steamer, hits against the closed top of the basket tube, and is disseminated through the combs, which it soon reduces to a fluid state. The wax and condensed steam run through the tube D into a vessel placed for their reception, while the dirt and refuse remain in the comb basket.

The basket can be cleaned by a liberal application of hot water in which washing soda has been dissolved, and the point of a brush will take out any stubborn pieces of dirt.

I may here say that all pieces of apparatus should be kept scrupulously clean; honey, like paint, can most easily be got rid of when fresh.

THE MECHANICAL PROCESSES OF SCULPTURE.

BY MARK MALLETT.

Casting from Nature in Plaster of Paris.

Waste Moulding from Nature—Moulding the Face and other Parts of the Human Figure—Taking a Mask after Death—Casting Animals, Leaves, Fruit, etc.

Moulding from nature is a branch of the art exceedingly useful to the modeller and carver. It gives him an absolute *fac-simile* of nature's handiwork, always fruitful in suggestions, and invaluable for reference: whilst to others who are no artists it offers an interesting and pleasing pursuit. There are many persons who have no turn for modelling or carving, but who would like to know how to take a successful cast of the face or even of the hand of a friend.

Both these things, and particularly the latter, may be easily done by anyone who has learnt from our former articles how plaster should be mixed, and moulds formed and chipped off. The difficulties, if such they may be called, of moulding from the living face, lie chiefly in providing for breathing during the operation, and in dealing with the hair. In casting the mask of a woman or a boy, the latter difficulty scarcely presents itself, and the novice should therefore first try his hand on one of these. There is another difficulty, perhaps, but this rests rather with the person moulded from than with the moulder, and that is that he or she may find it hard to keep perfectly still; this, however, has to be done, for any movement of the muscles of the face during the setting of the plaster will probably ruin the whole business.

The person to be moulded from—the subject, as we may call him—should either lie upon his back, or be so seated in a reclining position that the head can be thrown well backwards on a cushion. Means must be taken to prevent the liquid plaster going beyond the limits of the mask, which cannot well extend further than to the roots of the hair, the front of the ears, and a little way beneath the chin. Moulders have different ways of doing this; an easy one is by twisting towels round the face, and well tucking them in close to the skin. Whatever hair comes within the boundary, as the eyebrows and eyelashes must needs do, has to be plastered down with soap; for any loose hair will become embedded in the mould, and when that is removed will very likely be pulled out. Soap is better for this purpose than the grease used by some moulders, as the latter is liable to soften in the natural heat of the plaster evolved during setting. These preparations should be carefully attended to, but they need not be tedious, unless the subject is a man with a hairy face. The soaping down of beard, moustache, and whiskers, so that no straggling hair shall be left, must needs take time; and the flattening down of these masses will so change the appearance of the face that the cast from such a subject will rarely seem quite satisfactory. The eyes and mouth have, of course, to be kept closed during the operation, and breathing has to be provided for through the nostrils. Quills or reeds are often placed in them, but expert moulders prefer to keep air passages open by the use of the spatula alone. A very little olive oil should be rubbed over the skin.

It is well to mix the inner mould with slightly warm water; this is not only for the comfort of the subject, but because the application of cold plaster to the face is likely to cause such an involuntary motion of the muscles as might injure the work.

From the moment that the first spot of plaster is applied till the mould is thoroughly set, which may be ten minutes more or less, the subject must not stir any one of his facial muscles, after it is set till its removal he will remain motionless of necessity, and will probably grow somewhat impatient, for the sensation of being cased in plaster is scarcely an agreeable one.

For the sake of making the operation as short as possible, some moulders, instead of making an inner and outer mould, form the mould in one thickness only. This is a point for the exercise of private judgment; but if all things are, as they should be, properly prepared beforehand, very little time need be lost in making a parting between the two layers, and the convenience and safety of the inner coloured mould will not fail to be appreciated when the time for chipping out comes. For his own part the writer would always prefer to make the orthodox division in the mould.

The operator will, of course, have taken due care to include in his mask no more than will "leave" easily. In moulding from flesh he can, indeed, go farther than when dealing with a hard, rigid substance like marble, because flesh will yield. But he must remember that bone and cartilage will not give way so readily. For instance, should he extend his mould to behind the ears, he will find those members sufficient to prevent it from leaving. He must be careful on this point, as any error in this direction would cause much discomfort to his subject, and probably oblige him to break his mould.

Otherwise, nothing will be likely to interfere with the easy removal of the mould,

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unless it may be that certain small hairs will become embedded in it, and this it will scarcely be possible altogether to avoid. These may cause some trifling delay, as they will have either to give way or to be pulled up; and this may cause some slight pain to the subject. Though the mould when removed will look clean, the proper washing with soap and water ought not to be neglected, for without it mould and cast will not part so well.

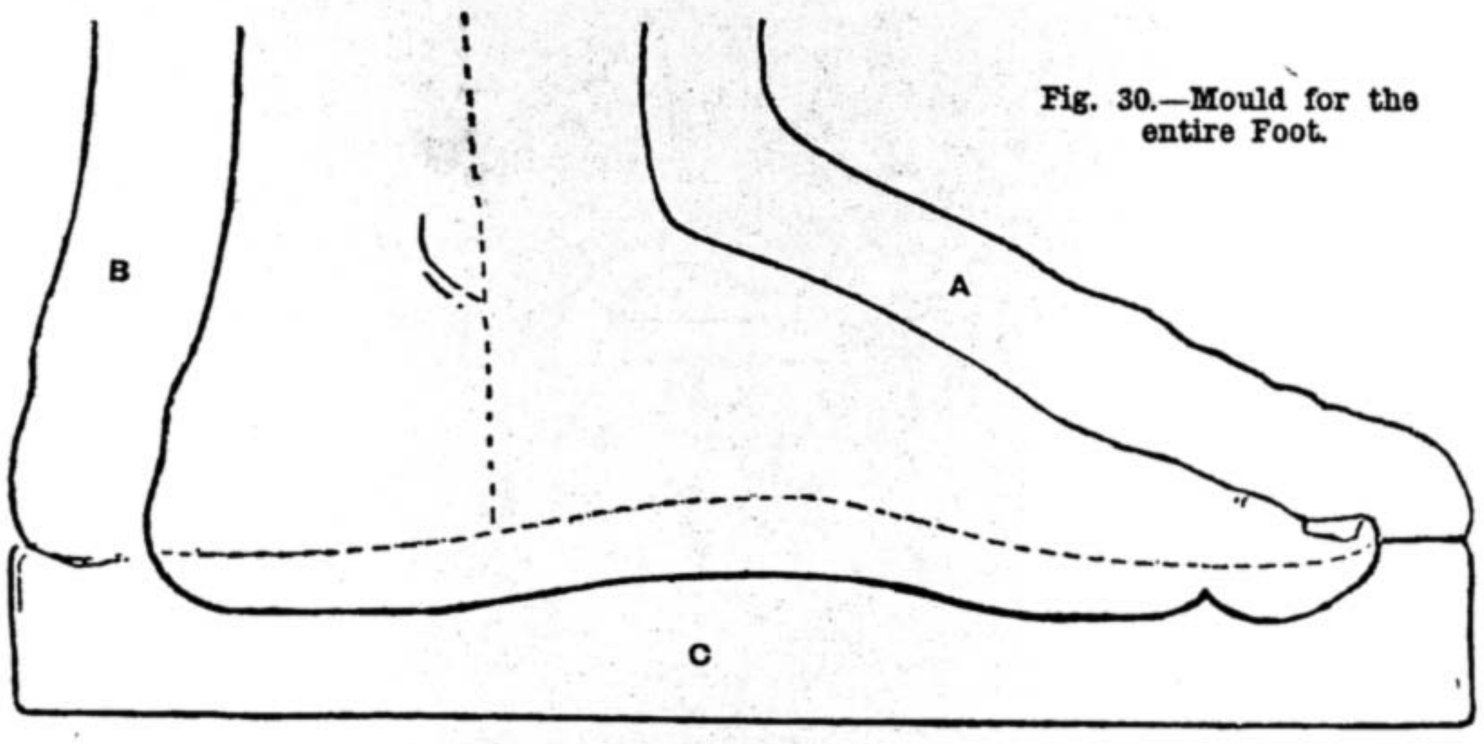

Fig. 30.—Mould for the entire Foot.

In a mask cast from nature the eyes, of course, appear closed. Anyone who has the skill can, of course, with some little labour, show the eyes, and if he chooses build up the remainder of the head and bust in plaster. Yet a bust so treated is rarely satisfactory; it looks what it is—a makeshift. If he can model well enough to do this, he will be wiser to model the entire bust in the regular manner in clay, using his mask as an authority; and in any case the best line to take with the mask is to mount it on a board covered with velvet, and keep it as it is.

Casts are occasionally taken from all parts of the human figure. From arms and legs the moulding is very simple, and the result generally satisfactory. There is more difficulty in moulding the "torso" (that is in plain English the trunk), since in the act of breathing the chest is constantly expanding and contracting. That energetic, and, if a man's own opinion be sufficient to establish his claim to genius, that highly gifted painter, Benjamin Robert Haydon, being greatly charmed with the finely developed torso of a negro model, made an attempt to mould it. He did this without taking the necessities of respiration into account. The result was that the plaster setting, the chest was unable to expand, and the fellow was all but suffocated. It was only by breaking the mould to pieces that Haydon restored to him the use of his lungs. Some more cautious moulder must have done the work with greater success, for the writer had for some years a cast of this man in his modelling room, complete in every part except the head.

The hand is an easy and interesting member to cast. Individuality and character are to be seen in it: the hands of an intimate friend often seem almost as well known to us as his face. Hence a cast of the hand is frequently a really valuable memento. As such, more than one side is rarely required to be seen, and the work of moulding is then particularly simple.

The hand may be laid, palm downwards, on a towel, the towel being so tucked beneath it as to fill up all hollows; or perhaps we may proceed with even less trouble by providing a soft pillow on which to lay the hand, for the pillow will so accommodate itself as to fill up all spaces. A towel can be rolled round the wrist at the point to which it is intended to carry the mould. The subject will take the moulding of a hand far more patiently than that of his face, and the operator can therefore proceed more leisurely.

When the mould is set, the whole hand, mould and all, can be turned over, and any little tongues of plaster which may have run beneath, pared away; the mould can then be eased where necessary so as to release the fingers.

If the hand is wanted in the round, so as to show both sides of it, the labour is greater, because the mould must be made in two pieces. The first half of the mould can be made on a pillow as before, the hand then turned over, and the mould trimmed where necessary, including the boring of key-holes along its edges. The second half can then be formed upon it, just as in casting from a clay model in the round. Or perhaps a better way, because it permits of dividing the hand more equally, is to bury one half of the hand in sand, to mould the exposed half, and then to proceed as before. When rubbing oil over a hand or foot previous to moulding, it is well to be particular in applying it round the nails.

The mould for a foot of which only the upper part is to be shown needs to be made in two portions, a front and a heel, the two meeting at the projection of the ankle. A towel can be arranged to prevent the plaster from the first made part of the mould going too far, though an expert moulder will make the division with his spatula merely. But sometimes a cast of the entire foot, in a standing attitude, and in the form it assumes when weight is thrown upon it, may be wanted for practical purposes. There are some persons, curious in the matter of their boots, who make a point of placing a cast from one of their feet in the hands of their bootmaker; and it must be owned that they show wisdom in so doing. To make such a cast it is well to knock together a shallow wooden tray, of length and breadth sufficient to receive the foot, and into this to pour plaster to a depth of three-quarters of an inch. On this, as soon as it is set, to place the foot, and to pour on more plaster, so as to encase all the sole and so much above as will leave with it. The edges of this have to be trimmed and key-holed, and upon it the two-part mould for the upper portions of the foot formed as before. In Fig. 30, such a mould is seen in section; A being the part enclosing the front, B that enclosing the heel, and C, that enclosing the sole. The tray will be taken to pieces before chipping out the cast.

Taking a mask after death is not a cheerful but still not a difficult task. The rigid features can no longer ruin the work by any involuntary movement, there is no occasion for undue haste when the subject can feel no impatience, and for the breathing which has ceased there is no more need to make provision. It is well to stop the nostrils with plugs of oiled cotton-wool, which can be pulled out afterwards. In other matters the process is the same as casting a mask from the life, but, except as regards dealing with the hair, without its difficulties.

If a posthumous bust is required, a mask taken after death is a most valuable aid to the modeller. The soft parts—the features—may, and probably will, have changed much, but the great landmarks of form will remain unchanged, so that from them the exact proportions can be faithfully reproduced, and photographs will enable him to restore what is altered or lost. Where no bust is needed the mask will form a melancholy but most precious memento of the lost one.

Among the lower living creatures, birds and furry animals are for obvious reasons not well suited to the purposes of the plaster moulder; but fishes, snakes, lizards, frogs, and all such like naked beings, suit him admirably. With these there is no difficulty beyond the mere trouble of packing, and this, so far as the writer's experience goes, is most readily done with sand. On this the creature can best be arranged for moulding in a single piece, should that be all that is required; or if the entire animal is wanted in the round, one half can be buried in the sand, the exposed part moulded first, and the other afterwards. The animals most easily dealt with are fishes and snakes; more skill and patience being needed to mould reptiles with feet.

Casts from such objects are much appreciated by those interested in natural history; and are of very great service to persons engaged in the decorative arts, wood and stone carvers more particularly. To these art workmen casts from vegetable forms are also of service—from leaves especially.

We may almost venture to say that no one has ever been able fully to appreciate the beauty which lies in those common leaves which grow around us who has not cast them or seen them cast in plaster. Looking at leaves in our ordinary careless manner, we take little heed of their curious serrations, of

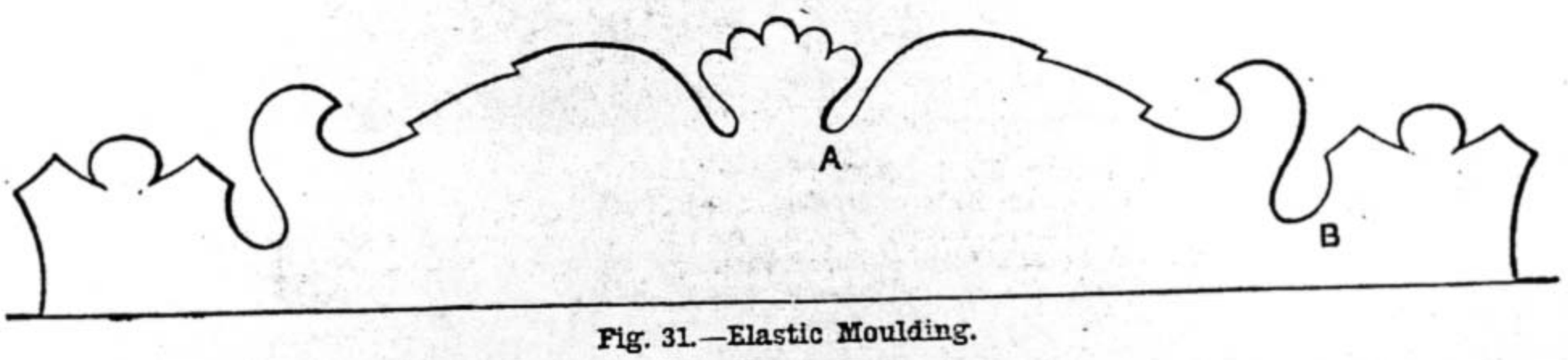

Fig. 31.—Elastic Moulding.

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their intricate veinings and markings, of their delicate curvatures. Their colour and partial transparency do something towards hiding these things from us. But when we see them emerging from the mould in the new, pure, white plaster, their marvellous workmanship forces itself upon our notice. The absolute fidelity with which this opaque and brilliant material reproduces all, even the most minute detail, delights and astonishes us—or if it does not, we must indeed be dead to all sense of admiration.

The way to reproduce a leaf in its beauty is not to press it down flat, or to lay it on a board, so that the weight of the plaster poured upon it will flatten it; we must preserve its natural curves. If we lay it upon the table we shall see that it is anything but flat, and that it rests only on three or four points. What we have to do is to pack sand under it as it lies, so as to give it a solid bed; we may then pour on our plaster. A leaf needs no oiling, and will, after the completion of the mould, readily come away, though a little easing is sure to be needed at the edges where the plaster may have overlapped them, especially if they are deeply serrated. Probably the bed of sand will have extended beyond the leaf on all sides, and some of it will adhere to the mould; it is not desirable to scrape this off; if left, it will, after the cast has been made, be seen to form a roughened background to the leaf, which will decidedly add to its effect, and set off its delicate modelling.

Groups and arrangements of leaves, admirable for decorative purposes, may be formed by the moulder if he has taste and judgment; and by judicious packing he will find little difficulty in casting fruits, berries, etc., in the same way.

CLOCK CLEANING AND REPAIRING.

BY A PRACTICAL HAND.

THIS paper, let me say, is on my favourite work, for before I went to the trade, at the age of twelve, I made a wooden clock, with wire pinions and thick tin 'scape wheel, a piece of steel legging spring for pallets, wooden rod pendulum, and bell-pull ornament for ball. It went well for years; but think of the time! Still, it was a labour of love; and when I look back at the age of forty-nine, I think of it as giving me the most genuine pleasure of all my work.

We read of Robert Ferguson, the Scotch philosopher, in his youthful days as a shepherd, making a wooden clock, and also a watch, after seeing one a friend allowed him to examine. He made the spring of whalebone, and spiral or hairspring of the same material. This watch went, so the book says, but I think only when it was carried.

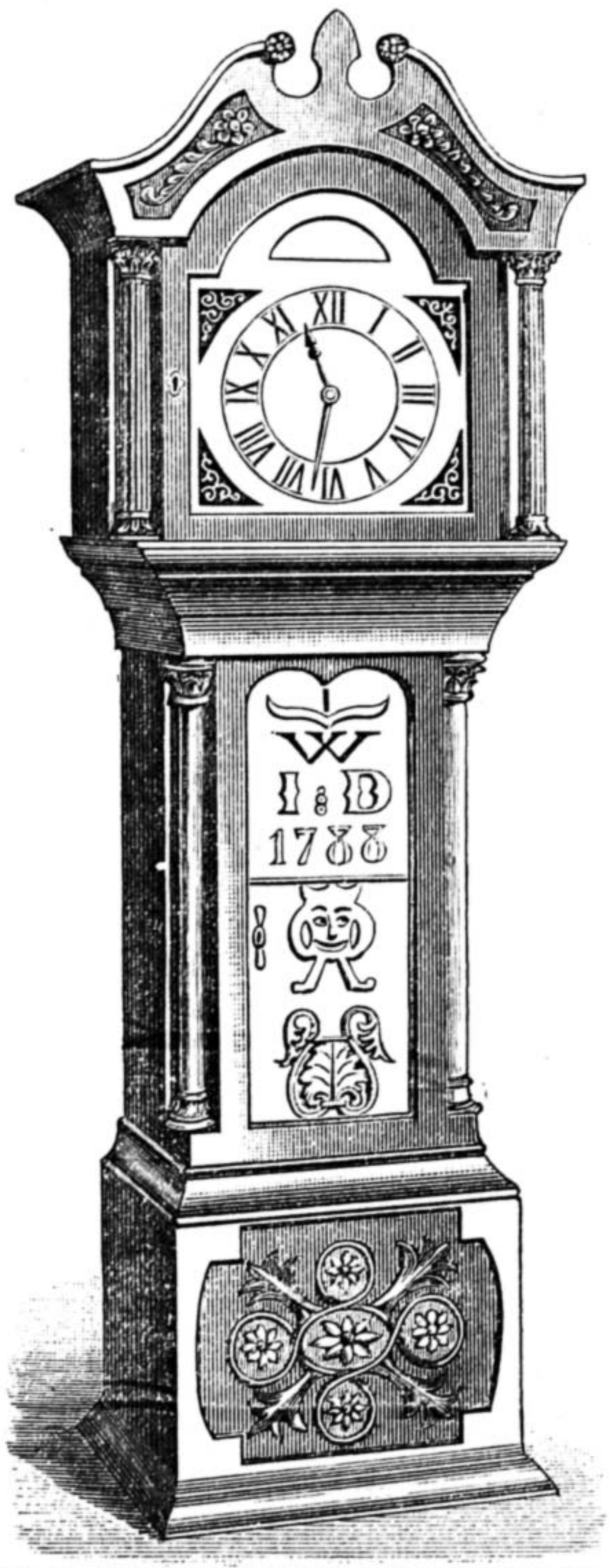

Fig. 1.—Grandfather's Chiming Clock. 18th Century.

Knowing what a difficult thing the escapement alone is to make, by those serving seven years in the good old days, the statement will not be believed by those who understand a watch; exaggerations in such cases are often made.

I next constructed a clepsydra or water-clock, which told the hours and quarters only with one hand. I made a tin cylinder eight inches in diameter with divisions inside—twelve equal, placed on the slope, and a small perforated hole same size and place in each—cemented on the end, and placed water in one compartment, and secured the hole I inserted water at. Then on the axis at one side I fixed a small reel, wound on my cord, attached a weight rather heavier than the water, and set the odd hand at the hour, and so the water commenced to slowly pass into the next compartment. It went all right, except timekeeping, doing it under the hour. But overcome that I must; so I cut from the weight layers of lead until it went as near time as an old verge might do, a *few minutes* either way. It wasa novelty for one thirteen years old; but winter came; alas! it ceased to work. We did not know of glycerine in those days, else it might have been overcome. To wind it up, I had to turn the whole affair, to coil up the cord on spool, reset hand, and off again.

When I began work in earnest as an apprentice, I constructed an original alarum to waken myself—at six in those days—to go to work. On the case of clock in my room I placed a pin to nearly touch the chain holding weight driving this clock; I marked chain at this pin at ten o'clock, and saw where it was at 5.45 a.m. Now I attached a cord and hook over a pulley on the side of wall a little from the clock, and further on near my bed I fixed a wooden frame with two eyelet pins, and the other end of cord with a wire to go between the eyelets of those two pins, and from this sliding pin I attached by wire loop a noisy canister of large size. Now, to set it, I passed pin through one loop, then put wire loop of canister on, and passed through the other loop. At ten I hooked on the pin part on clock chain, and when 5.45 came it was drawn tight and out of loop; down came noisy canister and aroused me at once. Rather clumsy, but effective, for a boy of fifteen. If a little sooner or later to bed than ten, I hooked on to chain a little higher or lower; it was easily reckoned. Next was a chiming clock; but I must leave the description for the end of these papers, when I will also describe a mysterious clock, transparent dial, and an electric alarum which I made, as they will no doubt interest many readers.

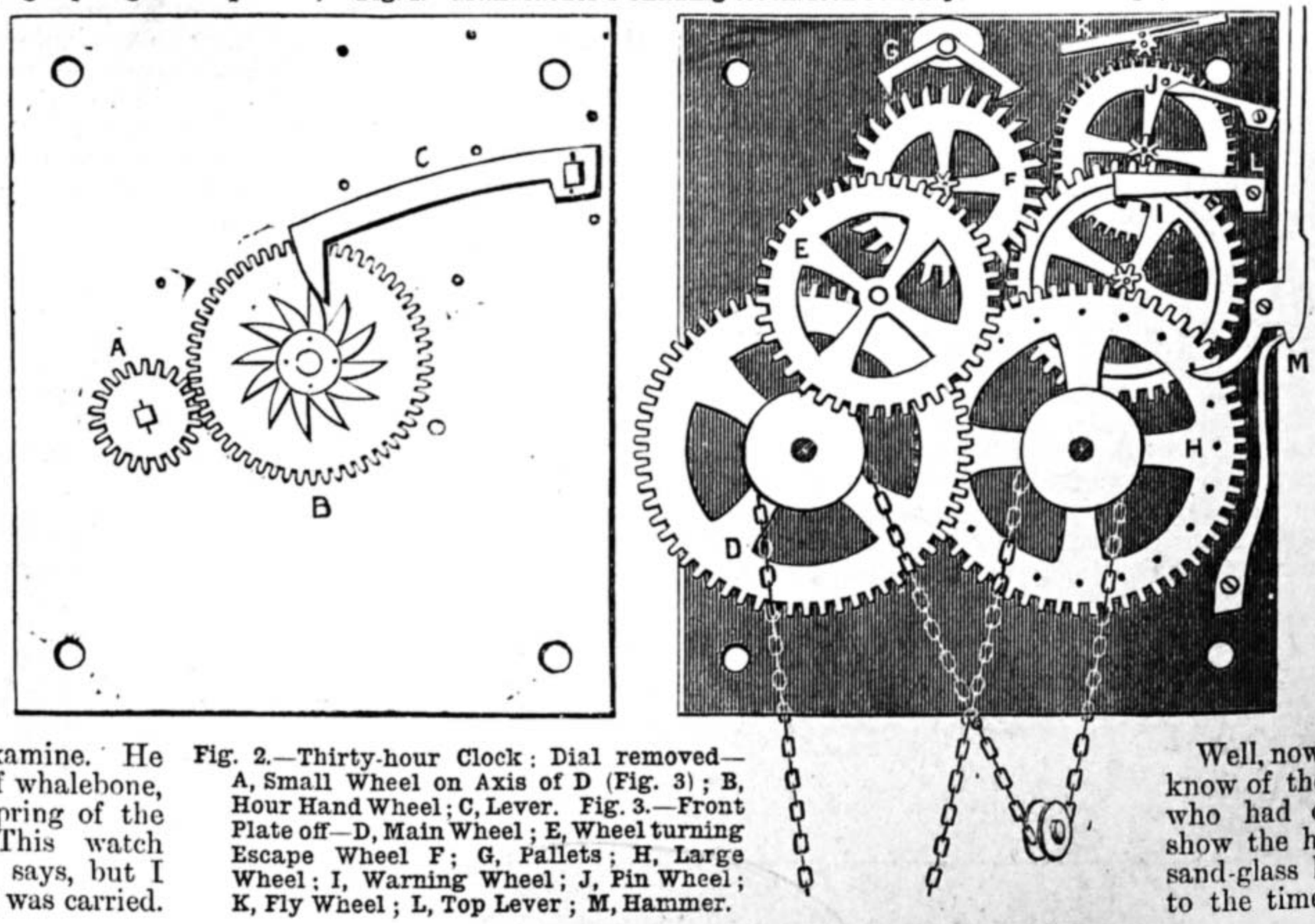

Fig. 2.—Thirty-hour Clock: Dial removed—A, Small Wheel on Axis of D (Fig. 3); B, Hour Hand Wheel; C, Lever. Fig. 3.—Front Plate off—D, Main Wheel; E, Wheel turning Escape Wheel F; G, Pallets; H, Large Wheel; I, Warning Wheel; J, Pin Wheel; K, Fly Wheel; L, Top Lever; M, Hammer.

Well, now to business. We all know of the good King Alfred, who had candles marked to show the hours by night, and sand-glass hours by day, down to the time when clocks went

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without pendulums, having an escape wheel on the top, with teeth like the old verge, and pallets same; and instead of balance rim, a hairspring had two weights so placed at angles on small arms that one was at rest when the other was raised ready to again receive its impulse—timekeeping very indifferent: one may be seen in motion now at South Kensington. But when Galileo invented the pendulum, from observing a swinging chandelier in the cathedral, clocks then began to be of use as accurate timekeepers, and sundials went into the realms of antiquity. Every form and style of clock imaginable have been constructed since that grand invention, even to those which will run one hundred days by once winding; they are partly after the plan of the common roasting-jack, several revolutions both ways occur before two teeth of the 'scape wheel pass onward. The clock nearest perpetual motion is in a church in the south of England: the large weight in one week goes down the interior portion of the steeple, and when nearly at the bottom it rests upon a lever which turns on a water tap, passing water into a small turbine water-wheel. This winds up the clock, and when nearly at the top by a connecting rod turns the tap back and waits another week. I know of nothing nearer perpetual motion (of any service) than that. The electric clock I would like to tell you of, but I must not take up further space.

Grandfather's Clock.—I will now give directions for cleaning and repairing a grandfather's clock, with a sketch of one in my possession, date 1788, ancient carving on the head, door, pedestal, etc., which is very much admired in this latter part of the nineteenth century: a 30-hour grandfather's clock, with dial removed (see Fig. 2); with front plate off (see Fig. 3).

In Fig. 2, A is the small wheel fixed on to the axis of largest wheel, upon which the chain acts; this turns B once round in twelve hours, carrying one hand. On this wheel is riveted the pointed toothed wheel which lifts the lever C, setting free the striking part of the clock (see Fig. 3), and causes it to give warning to soon strike the hour. This is done by lifting L out of its resting-place on the rim of wheel I, and allows the wheel J to nearly revolve once round. In putting together this is the only difficulty an amateur has to contend with, by not refitting so as to give sufficient warning, or when doing so partly raising the hammer, thereby causing it to strike first blow in a hurry. This is a tell-tale that an amateur has been at work.

The refixing of the chain will be a little difficult, but not so if you will jot down on a piece of paper how it passes over and under (see Fig. 3). One part from weight pulley goes over large wheel left-hand side and down to small lead circle; the other coil of chain passes from pulley to left side of large striking part wheel (this has a ratchet upon it), and passes over and down to small lead circle; you will see now it will wind all up that is required by one outside coil right-hand side. The pull of the weight is equal on both going and striking parts. I have heard it argued by men who ought to have known better that each received full weight. It is easily proved not to be so by attaching the weight by hook to a single chain, as the ticking is twice as vigorous.

The main wheel D turns E, which turns F the escape wheel, giving impulse to pallets G, whose crutch is moving the pendulum. I once remember an old country woman who had come five miles to get pendulum made right, for it was the only part that would not go; scarcely credible, but it is nevertheless true, not more than four years ago either.

Next we have the chain turning large wheel H, which turns warning wheel I, and this turns J, the pin wheel, which has a pin fixed so that it rests upon the lever; when warning is complete, this wheel turns fly wheel K, which completes the lot, except at the back of plate, where there is a wheel with twelve indents set at various distances to allow the arm of the lever inside to be held up until the number is struck. This wheel is turned slowly by a small wheel which is fixed upon axle of wheel H; it cannot be seen until count wheel is taken off. This small wheel is often liable to be lost, as it is only put on to the square end of large wheel axle, and in drawing this wheel out in taking asunder, the small wheel drops unnoticed by the beginner.

Having all to pieces, dip them overhead in paraffin oil to soften coagulated oil and dirt; this it does thoroughly; then wipe all dry, and thoroughly brush bright with larger brush and chalk or prepared powder. Then see all teeth are clear and pivot holes round and not too large; if so, fill in with brass, clinch both sides, and use your drill: not too large—it is easier to make larger, but not smaller, remember. Should the pallet face be worn hollow, place it in vice or piece of iron with a hole in it so that you can tap it gently with a light hammer and so move $\frac{1}{8}$th of an inch or so, and it will then be as good as ever, and have a larger swing in the pendulum. It may have already been moved by some clock jobber; in that case you must with a fine file level each face and *slightly* bring the two faces near; best to lay the pallet on a clean sheet of paper and mark or trace its shape. Now see when filed what it is short, and so make it right; it may save you further trouble.

Should the spring part top of pendulum be broken, which is very often the case, unscrew the brass square from rod, file the pin, and take out spring; replace with verge watch-spring, you will get plenty broad enough.

Should 'scape wheel teeth be worn, which no doubt they will, dress each one up neatly level and all *alike*, then smoothly burnish them with a piece of steel; if the pinion is much worn, best knock off the wheel and get one same size; do not tinker it. The other going part wheels wear very little, so will be all right. In striking part, the fly wheel, the top one, its pinion will be worn, as it does so much more work than the rest. Get a new one; the rest will be fairly good. A grandfather's clock being so well made, the parts I mention are about all that wear to any extent. After cleaning and repairing all well, take the back plate and place the three going wheels and pallet, then put on front plate, and by pressure of your thumb try if your repairing has affected the escapement. It will tick very rapid and easy if all right; if not, and it has a tooth where it stops, touch up with file. Now replace the whole clock, which is quite easy, except striking part—you have the going part in; place large wheel of striking side H next I, J, K, then the three levers; hammer, lowest hole, next front lever, above it stop lever, which drops into rim I. So place them that the hammer is at rest—that is, it has just passed over a pin—when the top pin is holding I secure, and the pin wheel J has about $\frac{3}{4}$ths or $\frac{2}{3}$rds of a revolution to make next time warning is given. To be clear and explicit, the pin in J must be that distance from the sloping lever end that rises to meet, this is where all amateurs fail. You cannot if you take notice as above.

Sometimes it may be put accidentally all right by an amateur; if after all you should get it wrong, so that it gives almost no warning, or the hammer is left ready for a blow, move the pinion out of the hole and pass next wheel on a tooth or two and try till all is right; now pin up and replace the small wheel and count wheel with the spring at the back, also small wheel and large hour wheel at front; run the chain over as I mentioned before and rejoin the link you open, or the weight falling sometime may alarm you. Oil all pivot-holes and a drop on the pallets; replace face (unless it wants relacquering or silvering), and fix on its only hand. To the original grandfather's clock the only thing now is the beat and the bell. Listen to the beat; if it goes unequal—heavy and light—raise up either side of the works a little until it sounds right; now let down again and bend the wire crutch at the back that moves the pendulum *towards the side held up* until you hear it equal; try again until right. Turn round the bell until it is at the loudest sounding part.

A NOVEL AND PRETTY FLOWER VASE.

BY JAMES SCOTT.

ANYTHING which is capable of being so treated that beauteous effects can be obtained in our homes should be welcomed by all workmen, professional and amateur. It may seem, after a perusal of these notes, that it would be but toyish to utilise my suggestions; but I will not be my own executioner by saying it would be so, nor shall I plead for mercy in the event of their being rejected as such. I give them as useful in some cases for providing a means of decorating our rooms by an inexpensive—very much so—method. I am not entirely original in this respect, as will be seen later on.

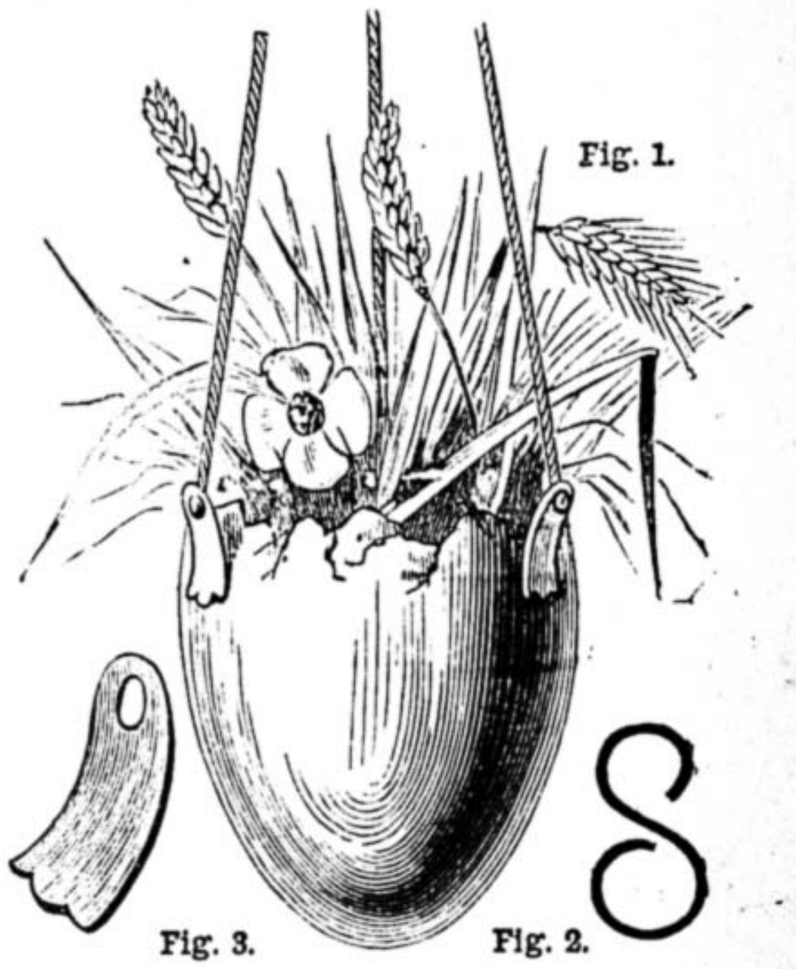

Fig. 1.

Fig. 3. Fig. 2.

Fig. 1.—Egg-shell utilised as Flower Vase. Fig. 2.—S Hook to support Vase when hung up. Fig. 3.—Shape of Tin Lugs or Ears for Vase.

Whilst cracking an egg-shell the other day, as a preliminary operation to the delightful demolishment of its contents, I bethought me that I could utilise the wasted and seemingly useless shells. It requires very little skill to eat the food portion of an egg without entirely destroying the outer covering. A few of these shells, with jagged edges, might be thoroughly cleansed inside and outside by some simple means, and the

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outside painted in a pretty enamel; whilst the inside could be filled with mould, and such humble green stuff as mustard and cress, or very small plants or flowers, grown within. A pin hole in the bottom of the shell would allow the water to escape when the mould was being fed; and I am sure it would not be thought too much trouble to hold a cloth underneath for a second or two to catch the drippings.

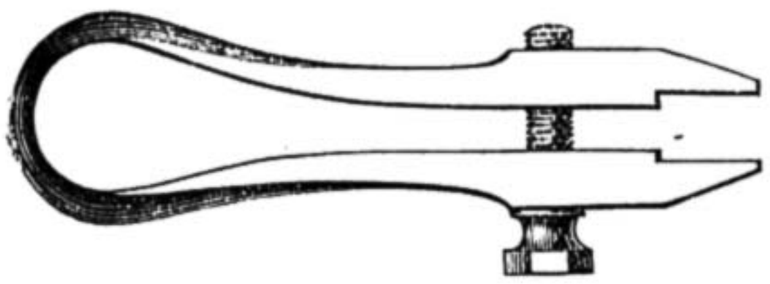
Three small chains or coloured cords could support these peculiar flower-pots. If small pieces of tin, such as are shown in Fig. 3, are cemented to the shells, they will serve as fasteners for the lower ends of the cords; and a small hook, like that in Fig. 2, can receive the top end. I frequently see genuine painted ostrich eggs, or porcelain imitations, hanging as flower vases, but the former are comparatively rare, while the latter are sometimes expensive. But were this not the case, they could not be placed so conveniently about an apartment as could the small ordinary shells.

At the sides of a mantelpiece, hanging from underneath overmantel shelves, or upon the wall between pictures, their humble effect would be appreciated. I might also suggest that a few hanging in any of the summer-houses made from the attractive designs of Mr. Yorke, lately given in WORK, would be found ornamental, and would not be likely to detract from the rustic appearance of the houses; in fact, eggs, unpainted perhaps, are an essential of pure rusticity, lying, as can often be seen, snugly in their nests. Someone may say, however, that flowers do not grow from these shells; but should this be their remark, I must remind them that summer-houses, however rustic in appearance, do not grow as such. I may also point out that the mode of treatment I have suggested will apply equally well to cocoanut shells, and to ostrich eggs when you can get them.

MEANS, MODES, AND METHODS.

THE PLIER NUT-WRENCH.

OF the endless diversity of screw-wrenches and spanners, it would seem that ingenuity had almost expended its resources. Some have come and gone, perhaps to be revived under the artificial stimulus of a patent, for many new inventions, if they can boast



Plier Nut-Wrench.

of no other merit, may claim it on the score of antiquity.

A screw-wrench for small nuts, and as a cycle fitting, has been wanted with a grip handle which shall turn end-on nuts as if by a screwdriver, and to have as few parts in making up as need be, so as to be durable and cheap. Here is one with only two parts, and a brass shoulder-collar, which will take nuts up to ¾ in. diameter—with end or side action for turning nuts on or off; or it may be used for a screwdriver, if a screwdriver blade, 1½ in. long, is handy, or awl, punch, or gimlet, all equally usable in the grip of this wrench, with its screwdriver-shaped hand-piece. The inventor is W. Witham, 22, Grove Street, Lisson Grove, N.W.—a well-known tool-smith. J. C. K.

AN ELECTRIC TIME ALARUM.

I send a sketch of an Electric Time Alarum and Switch Fitment, which I made myself, and has been working for the last six months; it is simple, and took but little time to make. It may be useful to readers of WORK who wish to be early risers.

My clock was an ordinary alarum, of which I took away the *bell* and left the other parts. Fig. 1 represents the front of the clock, showing the fitment of the alarum. Fig. 2 is a plan of the inside bottom of the clock, showing the switch

Fig. 1.

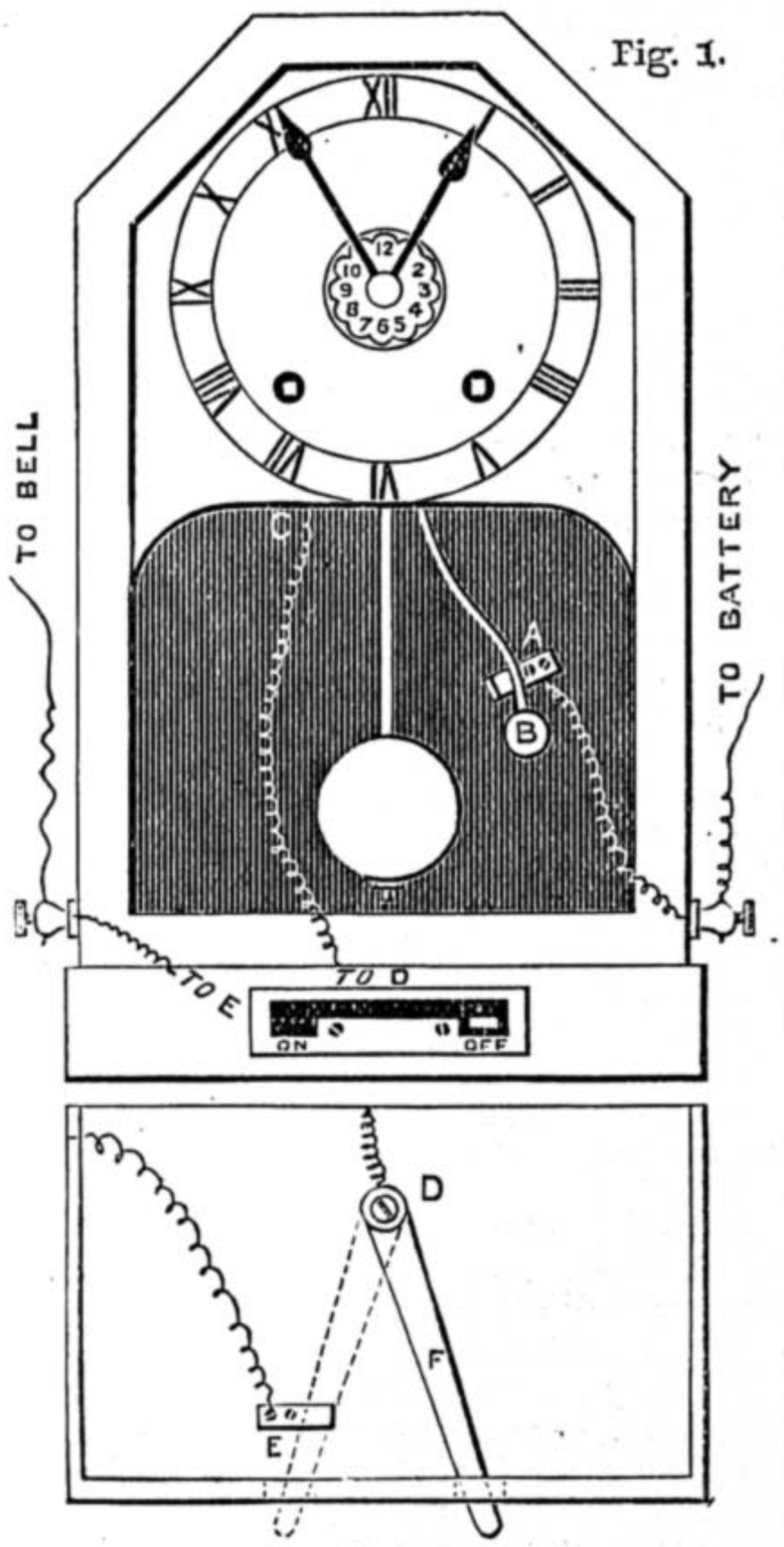


Fig. 2.

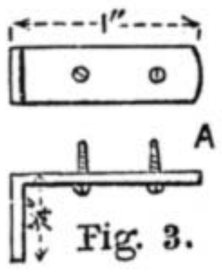


Fig. 3.

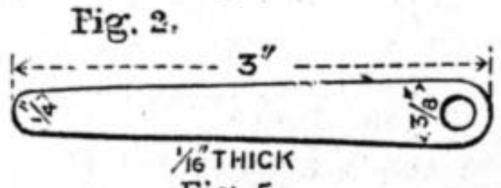


Fig. 5.

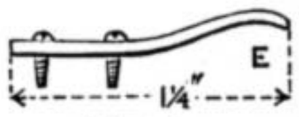


Fig. 4.

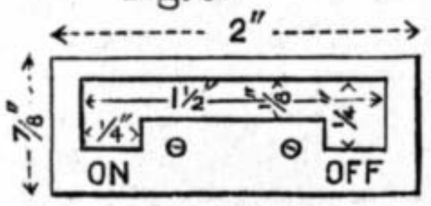


Fig. 6.

Electric Time Alarum and Fittings.

fitment. A is a piece of brass screwed to the back of the clock, in the shape of the letter L (or right angle), as in Fig. 3. B is the hammer of alarum bell, which comes in contact with A instead of bell. C is a wire connected to the works of the clock, and to D in Fig. 2. E is a piece of brass screwed to the bottom of the clock, bent as in Fig. 4. F is another piece of brass made as in Fig. 5, also screwed to bottom of clock at D, and forming a small lever. Fig. 6 is a brass plate, made as shown, and is screwed to the front of the clock, with ON and OFF stamped on it at each end; the small end of F projects about ¼ in. through it; a piece is cut out of the wood so that F works freely from ON to OFF. E is placed so that when F is brought over to ON the connection will be made. I can set it to any hour I like. J. G. B.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

97.—WINCH'S NEW FOLDING LETTER RECEPTACLE.

THIS consists of a netted bag attached to a small lath of wood about 7¼ in. long on one side, and to a thin board about 10½ in. long, and as wide as the lath is long, on the other. The lath is screwed to the door or shutter, as the case may be, and the board, which is furnished with two eyes at the top for this purpose, is hung on two hooks, which are screwed into the door about ½ in. above the letter-slit. The board in this position hangs over the slit in the door, concealing it from view and preventing direct draught. When a letter, newspaper, or any small article is pushed through the slit, the board is lifted, and that which is pushed through the opening in the door falls into the net, and remains there until it be seen and taken out. The receptacle can be made to lock if required. The "Folding Letter Receptacle" is made by Messrs. A. F. Winch & Co., 166, Rochdale Road, Oldham, in two sizes, sold respectively at 2s. 4d. and 8s.

98.—MARTIN'S BINDER AND TRIMMER.

Mr. James M. Martin, St. John's Hill, Edinburgh, sends a "Binder and Trimmer" for pamphlets, periodicals, etc., which will be found of assistance to those who wish to accomplish any rough and ready kind of binding, and to reduce the edges of their periodicals, a mode of treatment I do not like myself, but which may be of use under some circumstances. It is made, apparently, in five different sizes, from 1s. 6d. to 3s. 6d., the prices rising by increments of 6d. The apparatus consists of two frames, the upper one being smaller than the other. On one side of the upper frame are three pairs of wire points which fit over three uprights of brass plate set in the lower frame in the corresponding side. The periodical is placed with its back against the uprights, opened in the middle, and the lower frame is pushed against it so that the wire points pass through the back, each pair on opposite sides of one of the uprights. Wire staples are then put through the holes and bent over, which completes the operation for a single number. Many numbers can be bound together by turning the wires over tapes or bands the same width as the brass uprights. To trim the edges of a single number, or to cut any number of numbers to the same size, each must be laid on the lower frame, and the upper frame placed in proper position upon it. The edges are then trimmed with a sharp knife, the edges of the upper frame serving as a guide for the knife during the operation. The frames are of hard wood and nicely made.

99.—THE CANTILEVER ENLARGING APPARATUS.

This is the name of a new apparatus for enlarging photographs, designed and manufactured by Mr. William Hume, Scientific Instrument Maker, 1, Lothian Street, Edinburgh. It is supplied at different prices according to size and appliances supplied with it, ranging from £4 15s. for quarter-plate, or £6 10s. with enlarging objective, upwards. Judging from the illustrations of the instrument, and the description and instructions given in Mr. Hume's price list, I should take it to be a most desirable apparatus for the purpose for which it is intended.

THE EDITOR.

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SHOP:

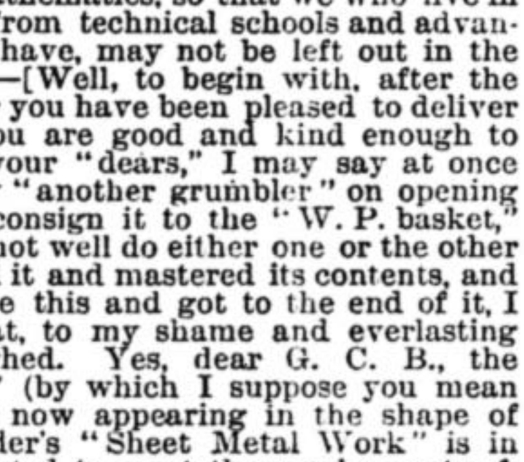
A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

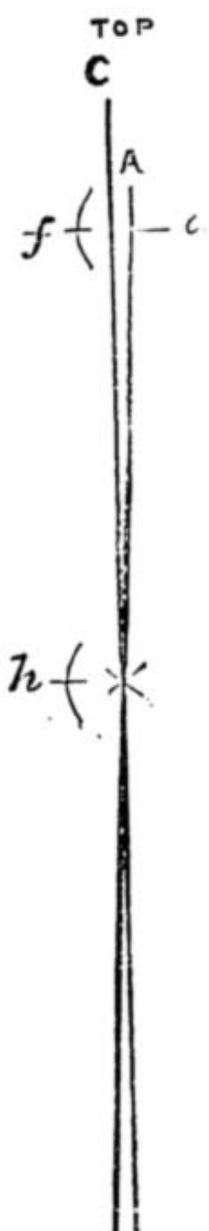
I.—Letters from Correspondents.

Geometry, etc.—G. C. B. (*Sutton*) writes:—"Dear Mr. Editor,—Yes, I daresay on opening this you will say, 'another grumbler,' and consign it to the W. P. basket. Yes; I am a grumbler with an object. In the first place, I should like to know if the articles now appearing on 'Sheet Metal Work' are in compliance with the wishes of the correspondents who asked for, and were promised, geometry for sheet metal workers. Now, you surely don't call the simple tawdle (*sic*) now appearing fit for practiable (*sic*) men; and again, your Mr. Alexander talks about rollers, wiring machines, and a host of other tools only to be found in first-class shops; why, in very few jobbing shops will you find even a jenny. And then, again, just the very things one wants to know how to make—oh, you must buy them ready-made. I refer more particulary (*sic*) to bent kettle spouts. Now it frequently happens that a kettle comes in with the spout burnt off, a straight one is put on, and everyone knows how difficult and dangerous it is to pour boiling water from; but what is to be done? no ready-made ones in stock, and the boss not inclined to buy any; he says, make some when slack; the queston (*sic*) is—how? This is only one instance; but others are met with daily in a country jobbing shop. I trust soon to see articles on practical geometry and mathematics, so that we who live in the country far from technical schools and advantages town men have, may not be left out in the cold altogether."—[Well, to begin with, after the very severe facer you have been pleased to deliver to one whom you are good and kind enough to number among your "dears," I may say at once that I did not say "another grumbler" on opening your letter, and consign it to the "W. P. basket," because I could not well do either one or the other before I had read it and mastered its contents, and when I had done this and got to the end of it, I must confess that, to my shame and everlasting disgrace, I laughed. Yes, dear G. C. B., the "simple tawdle" (by which I suppose you mean twaddle) that is now appearing in the shape of *my* Mr. Alexander's "Sheet Metal Work" is in every way calculated to meet the requirements of, and is perfectly "fit for, practiable (by which I presume you mean practical) men, and I may assure you at once that letters are received which show that many are profiting by the papers that *my* Mr. Alexander is writing, and especially in this way—namely, that when they pass from a "jobbing shop" into a "first-class shop," as most, if not all, of them who are not already in the latter are seeking to do, they will find themselves all the more at home in their new sphere of labour than they could possibly have done had Mr. Alexander done the thing which he has not done, and ought not to have done, by taking up your line of treatment, and entirely ignoring the machinery which has been introduced to facilitate operations, abridge labour, and therefore lessen cost of production in the tinplate worker's craft. Now you clearly wish him to come down to your level by talking, or rather writing, about matters which most young apprentices would understand, and which ninety-nine out of a hundred journeymen would not care for. He, on the contrary, wishes you to come upstairs to his level; and if you will make up your mind to study his papers with care, you will certainly be able to get up half-way, if you do not reach the top landing; and I presume you have some desire to get out of the jobbing shop into the first-class shop, which is infinitely better than getting out of the frying-pan into the fire, which you have unfortunately done in this case. I am not a tin-plate worker myself, but although many people are inclined to "write me down an ass," and do so sometimes to such an extent that I voluntarily touch my ears to ascertain to see if they still remain *à la mode*, or have assumed a long and hairy form like those of Midas, yet in the matter of bent kettle spouts, it would not puzzle me to accomplish the bending of a straight spout into the form shown in Fig. 6 (page 499), by filling it with lead, and then coaxing it into the desired form with a hammer, after which the lead must be run out; and to understand that spouts like Fig. 7, which, with Fig. 6, I reproduce here to save readers the trouble of reference, are made in halves, and then brazed up. I have asked Mr. Alexander to enlighten you on this point, and you might have arrived at the information without throwing bricks at him, metaphorically speaking, by simply asking the question; but now you must wait for the enlightenments until the tea-kettle question comes to the front, when the formation of a bent spout will no longer remain a mystery to you or anybody else. But now I am brought face to face with a fact which "everybody knows," but of which I have hitherto remained miserably ignorant—namely, that it is both "difficult and dangerous to pour boiling water from" a straight spout—an operation which I have been permitting the feminine portion of my family to perform daily for many years, when manipulating the coffee-pot at the first meal of the day. How truly thankful I ought to be that they have hitherto escaped disfigurement through accident, if nothing worse, which might have arisen from pouring hot coffee from a pot with a straight spout! Well, it is never too late to learn, and thanks to you, dear G. C. B., I have added to my limited knowledge, and am better informed now than I was before I received your letter. And now I must put you to a little pain, as the surgeon said before sewing up a scalp wound in a broken head, by telling you that it is of no use to put any trust in the appearance of "articles on practical geometry and mathematics" in Work, "so that *we* who live in the country, far from technical schools and advantages town men have, may not be left out in the cold altogether." But according to your letter, you hail from Sutton, Surrey, and, according to my notions of the geography and topography of the home counties, Sutton is only thirteen miles from London by the London, Brighton, and South Coast Railway, and therefore not so far from the metropolis as to prevent you entirely from the benefits to be derived from the technical schools that are to be found therein. Besides, I trust—you see I am going to do a little in that line now—that you may soon have a technical school at Sutton. Meanwhile, let me remind you that there is an admirable series of "Lessons on Practical Geometry" in both the "Popular Educator" and the "Technical Educator," published by Messrs. Cassell & Co., which I cordially recommend to your notice, and that, if you prefer such lessons in a collected form, you will find them in "Linear Drawing" and other volumes of Cassell's Technical Manuals. Work is, of course, an educational journal from one point of view; but there never was, and there is not, the slightest intention of conveying elementary instruction such as you ask for in your letter, and which has been already completely and efficiently supplied in the educational works and elementary textbooks to which I have referred. You might as well ask for "Lessons in Spelling," or for the beginning of all knowledge that is taken in by the eye as well as the ear—namely, the alphabet.—Ed.]



Bent Kettle Spouts.

Gaiting Wheels.—Worker Bee writes:—"With reference to my note on this subject (see 'Shop,' Section I., page 519 of Work), the accompanying sketch was omitted from my text there. It is now presented, and will serve, I hope, to make my remarks the more understood."

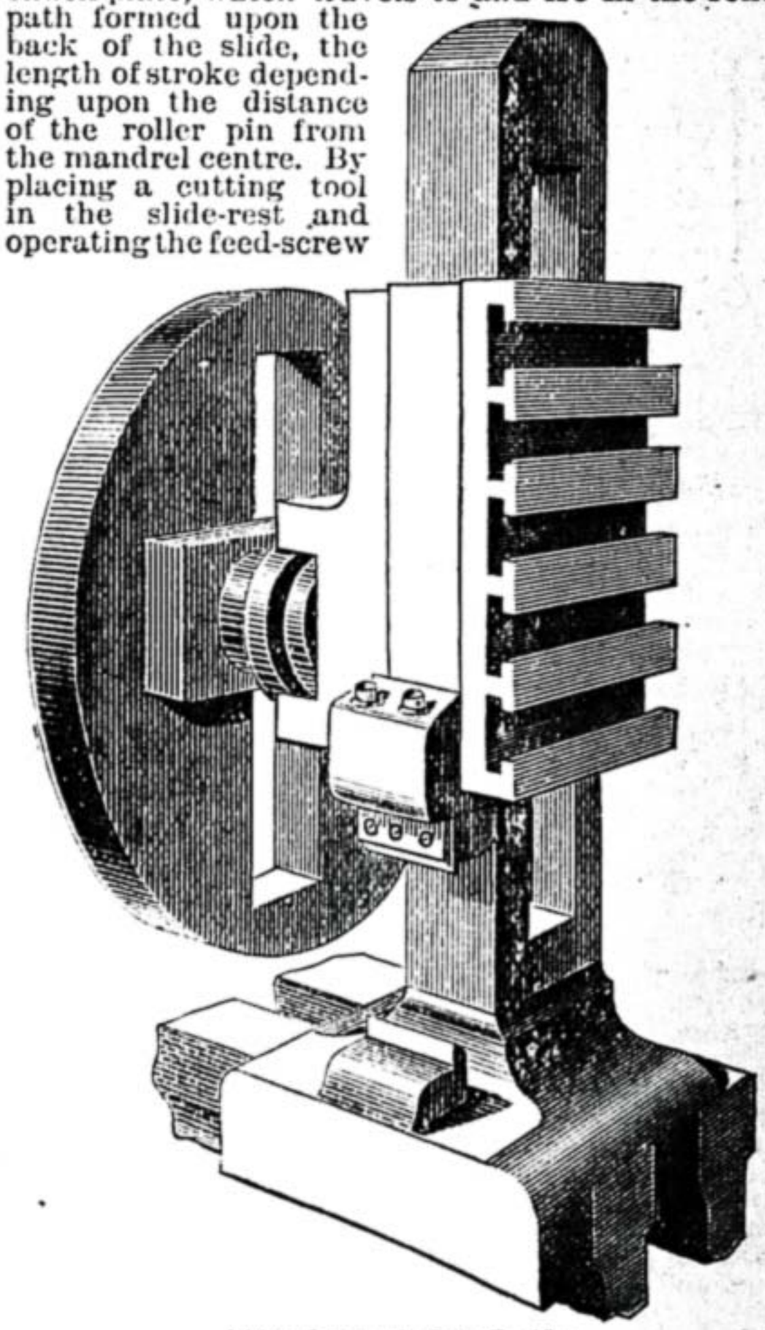


Gaiting Wheels.

How to Fret a Banjo.—J. G. W. (*London, N.W.*) writes to R. H. H. (*Crewkerne*) (see page 503, Vol. II.):—"Have you read my instructions 'How to Fret a Banjo'? (Vol. II., No. 70); and if you have read them, have you given them a practical test? I did not say divide the neck of banjo into eighteen equal parts with a pair of *compasses* or *spring dividers;* the distance between the points of compasses will give the exact distance from the nut to the first fret; then divide the distance from the first fret to bridge into eighteen equal parts: that will give the distance from first to second fret, and so on with the others, dividing from each fret to bridge into eighteen parts. I say again that this is the best and easiest method to fret a banjo, and until someone can show me something better I shall continue to adopt it. Of course it requires patience and care in setting out a scale: there are no 'near enoughs' about it; it must be exact. While writing this I have tested a mandoline I have made and fretted by the method I give, and find that it is practically true, if not theoretically; so, therefore, if the method I give is suitable for fretting the short neck of a mandoline, it is perfectly clear that it will do for fretting the neck of a banjo. You give an elaborate lot of figures, giving the distances for fretting Brewster's 'grand orchestra model,' which, by the way, has a 13 in. hoop, and not, as you state, a 12½ in. Would you be surprised to hear that this maker's banjos are fretted by precisely the same method that I gave in Vol. II., No. 70? Very funny, isn't it? If you will write to the Editor for my address, I will mark off and send you one of my fretting scales to test, if you are still not satisfied."

Motto for Work.—An Old Subscriber writes, in sequence to J. W. H., as follows:—"On page 504 of Work, Vol. II., under heading 'Cork-cutting Machine,' you suggest that '*Ab uno disce omnes*' would be a good standing motto for the periodical. So it would. But will you permit me to suggest a shorter, and an equally appropriate one—viz., '*Solvitur ambulando?*' For, in all matters coming within the wide scope of Work, the difficulties of every kind experienced by subscribers (professional as well as amateur) are removed with such admirable lucidity by the staff of Work that it becomes a pleasure not only to those who live thereby, but also to such as, like myself, take it in hand to occupy a leisure hour."

Improved Attachment for Lathes.—F. M. R. (*London, E.C.*) writes:—"The apparatus shown in the accompanying illustration will be found a very useful adjunct to a lathe or any similar tool from which a vertical reciprocating motion can be obtained. It consists of a standard which is bolted to the bed of the lathe; upon this slides a grooved face-plate, to which is secured the work to be tooled. This face-plate is moved up and down by a roller mounted upon a pin bolted to the ordinary lathe chuck-plate, which travels to and fro in the roller path formed upon the back of the slide, the length of stroke depending upon the distance of the roller pin from the mandrel centre. By placing a cutting tool in the slide-rest and operating the feed-screw by hand or by means of self-acting motion obtained from the slide, metals may be planed, shaped, key grooves cut, and a variety of other tooling work accomplished with accuracy and rapidity. For the convenience of light metal-workers, a punch and pair of shearing blades can be added for cropping plates and roughing-out material. The grooves upon the sliding face-plate can, when desired, be replaced by a vice for holding the work, or a vice can be bolted to the grooved face-plate. The illustration is taken from an attachment fitted to a 4 in. centre lathe, which has a stroke of 3 in.; a speed can be obtained of 50 to 200 strokes per minute."



Attachment for Lathe.

II.—Questions Answered by Editor and Staff.

Unsightly Cupboards.—Cupboard.—No end of resources are open to you to render your cupboards sightly instead of being an eyesore. Do away with the crimson calico, and paint the glass in some flat but genial tint. Then you might ornament the panel grounds with *fleur-de-lis* or other stencil patterns in another colour. Or you can obtain some of the imitation stained glass patterns sold largely in London. If you refer to the Index of Volume I. of Work, you will get several hints as to decorating

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in this way. A coat-of-arms or motto might be worked in.—C.

Bicycles.—THE IRISH CYCLIST.—Our contemporary, "The Irish Cyclist," criticising an article on "A Few Hints to Intending Purchasers of Cycles," Vol. II., No. 66 of WORK, remarks:—"To commence with, the author conjectures that the reason why riders put their saddles back is to secure adhesion of the driving wheel to the ground, whereas a rear-driving wheel requires no such thing, and the only reason a safety or tricycle rider puts his saddle back is that he wishes to *sit behind his pedals.*" In this sentence our contemporary jumps to a very false conclusion. It was not the author's idea to convey the impression that the *riders* put their seats back any more than that they had the handle bars placed too far forward or too high, but that the *makers* did it and did not allow sufficient adjustment to move it forward if the rider desired. I myself do not think that 20 per cent. of the riders know that they are increasing the adhesive power of the driving wheel by placing the seat further back over the centre of the wheel. I have on several occasions met men on the road who have complained that they could not sit upright on their machines on account of the seat being so far back, and yet at the extreme limit of its forward adjustment. Again, I have met them with the handles almost as high as their chests, and not capable of being lowered. In these cases the riders wanted a better designed machine, as the design only was at fault. The article of WORK was written to prevent such machines being bought. In answer to our contemporary's last and most important remarks, I have made

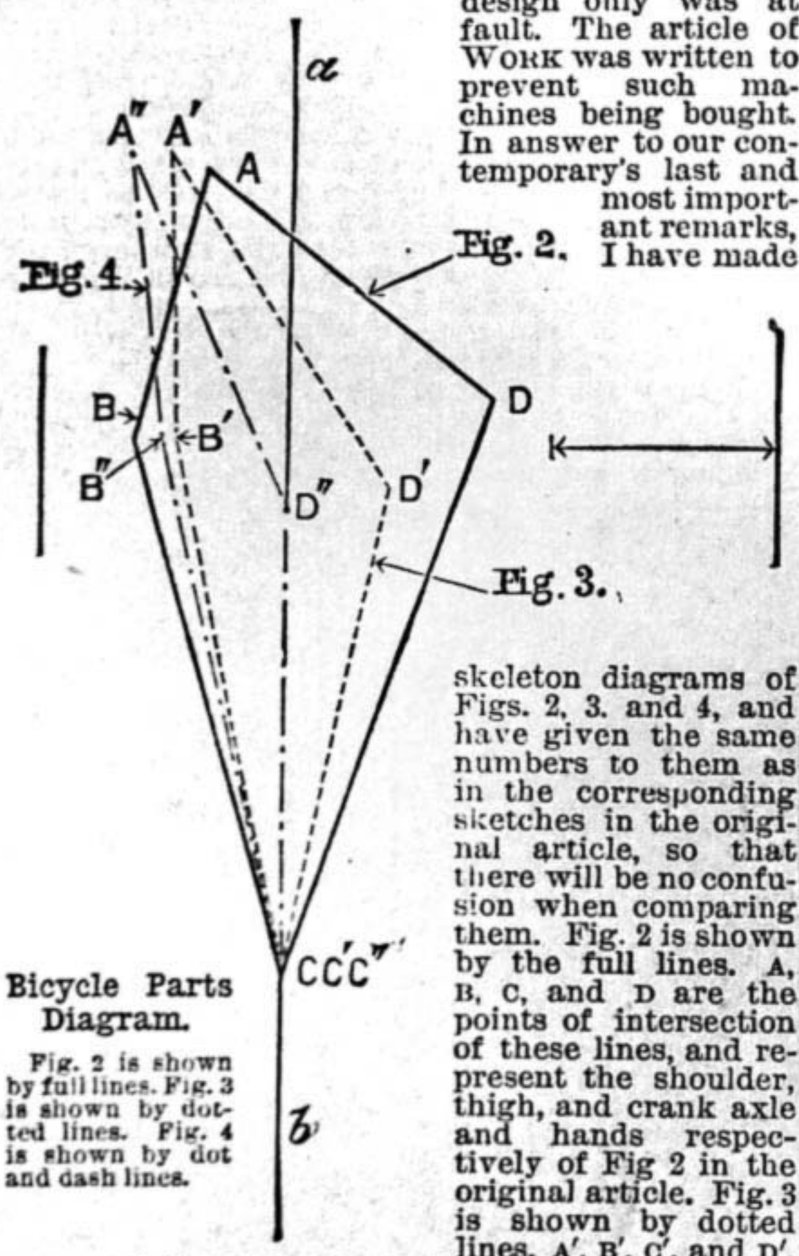


Fig. 4.

Fig. 2.

Fig. 3.

Bicycle Parts Diagram.

Fig. 2 is shown by full lines. Fig. 3 is shown by dotted lines. Fig. 4 is shown by dot and dash lines.

skeleton diagrams of Figs. 2, 3, and 4, and have given the same numbers to them as in the corresponding sketches in the original article, so that there will be no confusion when comparing them. Fig. 2 is shown by the full lines. A, B, C, and D are the points of intersection of these lines, and represent the shoulder, thigh, and crank axle and hands respectively of Fig 2 in the original article. Fig. 3 is shown by dotted lines. A', B', C', and D', represent the same parts respectively as above, but in the positions of Fig. 3 of the original article. Fig. 4 is shown by the dot and dash lines. A'', B'', C'', and D'' represent the same parts respectively as above, but in the positions of Fig. 4. In the diagram, Fig. 4, the handles D'' and the crank axle C'' are in a vertical line and not inclined, as shown in the original sketch; the reason will be explained later. In the diagrams I have taken the crank axle as the common centre and drawn a vertical line *a b* through it, and then marked off the relative positions of the shoulder, thigh, and hands in each sketch. Fig. 4 represented, in the author's judgment, the best relative positions of the seat (represented in diagrams by thigh), handles, and crank. The seat and crank in Fig. 3 were intended when drawn to be in the same relative position to those in Fig. 4, and when due allowance has been made for stretching forward to reach the handles, very little more is necessary for inaccurate drawing, as will be seen by the diagrams, in which, if the point D', representing the handles, were brought to D'', the points A' and B' would almost coincide with A'' and B'' respectively of Fig. 4, thus producing the same "ideal" position for the safety as for the ordinary. Our contemporary continues:—"In brief, the only defect of the attitude in Fig. 2 is that the handles are too forward. Bring them back (as they would be brought back in almost every first-class machine of the time), and the rider can sit upright on his saddle." There must be some difficulty about bringing the handles in the safeties as near the body of the riders as in the ordinaries, or we should surely have had some enterprising maker to the fore with them; but up to the present no such machine has been noticed by the author. If the rake of the fork or the bend of the handles were excessive, then it could be arranged; but most probably there would be some unforeseen defect conducing to back steering. This Fig. 2, as will be seen from the diagram, is not, as our contemporary asserts, nearer the "ideal" position, Fig. 4, than Fig. 3 is, and the only defect of this figure is not, as our contemporary asserts, that the handles are too far forward, but as stated in the original article, "The principle defect of this figure is that the handles are too high." In the original Fig. 4, the handle and the centre of driving wheel, though shown slightly out of perpendicular, were intended by the author to be in a vertical line; but the block evidently got slightly twisted, which in this position makes the horizontal distance from the seat to the centre of the crank axle more nearly coincide with Fig. 2 than Fig. 3, which mistake principally called forth the remarks of our contemporary. If the author of the criticisms will now kindly follow the advice given to us and set up perpendiculars through the crank axles of the sketches they have reproduced, and measure the horizontal distances between these and a point representing the thigh bone of the riders (this measurement is preferable as the nose of the saddle is not visible and the back is not so accurately drawn), he will find that Fig. 4 is so twisted that it now more nearly coincides with Fig. 1, which he admits is a bad position, than with any of the other sketches. I think, when, even in copying four sketches, such a mistake is made, that our contemporary might allow a little more latitude in the original designs.—P. B. H.

Opal Letters.—W. H. C. (*Ilkeston*).—You will obtain these of Messrs. Nash & Hull, 202, High Holborn, London, W.C., or of the Patent Letter and Enamel Co., Limited, 144, High Holborn, London, W.C.

Self-acting Fountain.—E. E. B.—The cause of the delay in playing evidently arises from the pipe getting choked with air; possibly you have made the bend too sharp; you can always readily relieve it by blowing down the jet hole sharply; in any case it will right itself in a few minutes if let alone. With regard to the height of jet, it depends upon the bore of the tap; some are very narrow and straight; the best are the widest and conically shaped; if you do not like the 14 in., get an "oil-can nozzle," and use instead; this will give you the full height possible.—C. M. W.

Salt in Bunsen Battery.—J. M. (*Newcastle-on-Tyne*).—A solution of common salt may be used in the zinc compartment of a Bunsen battery instead of a solution of sulphuric acid. The chief disadvantages of this solution are:—(1) It increases the internal resistance of the cell, and, consequently, there is less available current in the outer circuit; but this is not very marked at first. (2) It crystallises in the pores of the porous cells, and soon bursts them above solution line unless soaked in warm water after each time of using. (3) It forms with the zinc a muddy deposit in the cell, and thus makes the battery more dirty than when used with sulphuric acid. (4) The force of the current is slightly less with this solution. The zincs should be as carefully amalgamated to use with this as with other solutions. Wash the zincs in hot soda water to free them from grease before immersing them in the acid pickle, and let this also be warm. You will then have no difficulty in getting the mercury to adhere to the zinc.—G. E. B.

Direction of Current from a Coil.—MAC.—The direction of a current from the secondary wire of an induction coil, whether a medical or a spark coil, is opposite to that circulating in the primary wire of the same coil. The following is a simple method for detecting the direction of an electric current. Dissolve a small piece of copper sulphate (bluestone) in a small quantity of water held in the bottom of a china egg cup or similar small vessel. Connect a scrap of copper foil or large copper wire to each of the terminals of the coil by means of a length of copper wire, and immerse the two scraps in the copper solution. Now pass a current through the coil and note the condition of the copper scraps. One will be corroded by the current; mark this one P, as it comes from the positive pole of the coil. The other scrap will receive a deposit of copper; mark this N, as it comes from the negative pole of the coil. The direction of the current is from positive to negative. Note how the battery was connected to the coil, and always connect it in this way again to be sure of the direction of the current.—G. E. B.

Chair Stuffing.—R. E. H. (*Llanrwst*).—Without seeing the chair, or having actual measurement, it is extremely difficult to explain in anything like a reasonable space how you are to manage. The leather, or whatever the covering is, must be set out for the buttons, and to allow for the pleats, a certain fulness must be allowed both lengthwise and across. For such a chair as you describe I should say a fulness of about ¾ in. would be somewhere near the mark. Remember that the greater the fulness the deeper the pleat can be. In case you do not understand what is meant by the extra fulness, let me say that the covering must be larger by this calculated each way by the number of buttons there would be required for plain covering. Thus, if you have three buttons in a row, allow accordingly.—D. D.

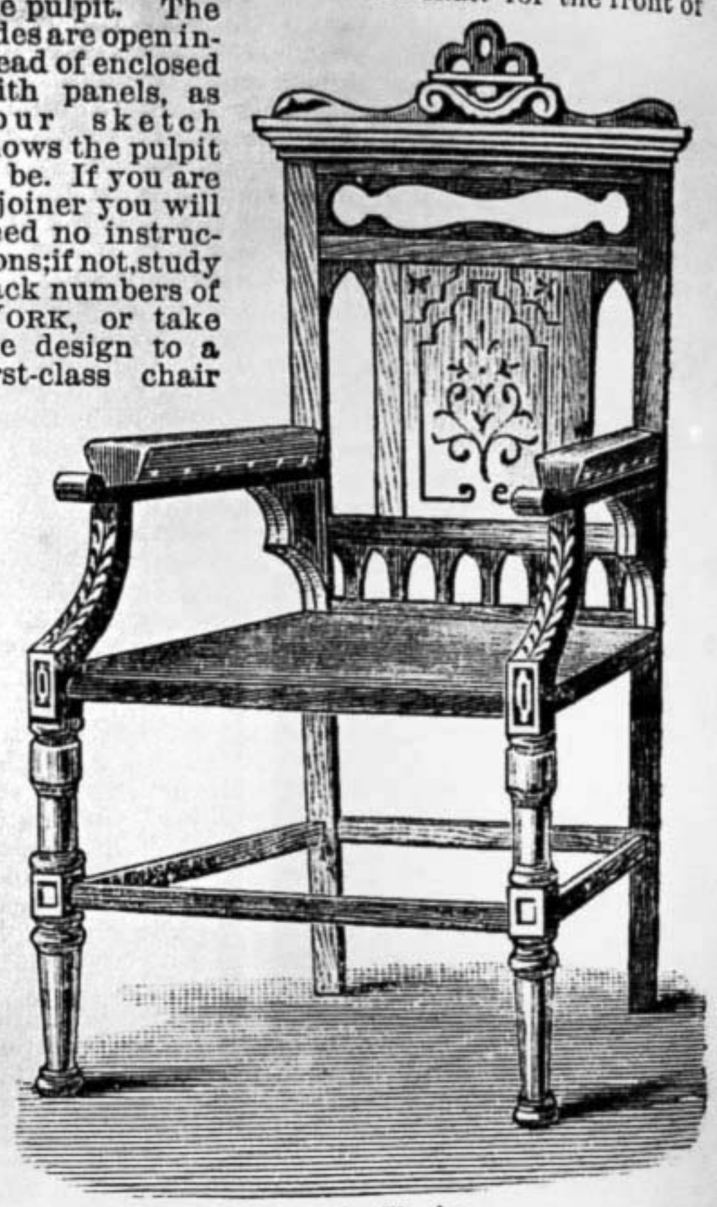
Boring Pinion Wheel.—AMATEUR FIFE.—If your wheel is 12 in. in diameter, and requires a hole of only 1¼ in., I think it should be called a wheel, and not a pinion; if it has arms, you can put it on a face-plate with a little block of wood under three of the arms; let the blocks be of such a height as to lift the rim off the face-plate by about 1 in. all round; adjust thickness of blocks till the rim stands off the plate exactly the same distance; place it as nearly as you can measure in the middle of the plate, and clamp with dogs or bolts passing through the face-plate; then put it on the lathe, and, after centring correctly, clamp it fast. If your wheel has no arms, screw three pieces of hard wood board to face-plate; turn out a recess in these, and fit wheel in, and clamp with bolts.—F. A. M.

Canoe Building.—AMATEUR CARPENTER.—You had better purchase No. 53 of WORK, containing an account of how to build a canoe and of what wood.—L. Y.

Paste for Parchment.—J. S. H. (*Stockton-on-Tees*).—The best thing you can use, as far as I know, for sticking pieces of parchment together is the "Stick-All Cement," sold wholesale by the "Ever-clean Collar Company," 100, Wood Street, London, E.C., who send out sample tins at 9d. and 1s. 3d., post free. It is the *stickiest* stuff with which I am acquainted, and I have seen it used on fractured earthenware and plaster images with excellent effect.—ED.

Alteration of Tricycle.—W. H. (*Gateshead*).—If you will send me a sketch or woodcut of your machine, showing position of cogs, framework, etc., and height of wheels, I will give you full particulars and drawings for altering your tricycle.—F. C. P.

Church Chair.—W. B. (*Howden-on-Tyne*).—I submit a sketch of a match chair for the front of the pulpit. The sides are open instead of enclosed with panels, as your sketch shows the pulpit to be. If you are a joiner you will need no instructions; if not, study back numbers of WORK, or take the design to a first-class chair



Church Chair.

maker. I cannot understand whether your sketch intends to show half spindles faced on to the pulpit, or merely gothics; but you will have no difficulty in altering my design accordingly, if wrong.—J. S.

Painting Cart.—M. T. W. (*Warbleton*).—Refer to No. 65, page 209 in "Shop," Vol. II.; you will see my answer on painting a polo cart; also in No. 81, page 473 of "Shop." The secret of coach painting lies in getting the under or groundwork up preparatory to painting, and not in giving it a great number of coats of paint, which would only tend to make it rougher. As you wish to pick out the wheels with white, if to be varnished over the same day, get some dry white lead and grind in gold-size and turps, adding a little blue to it; or, if you varnish the cart the day after, mix some pure tub white lead, a little varnish and turps, also a little blue in it, to keep the varnish from turning the white yellow. In picking out, hold the liner between the thumb and finger of the right hand, using the other three fingers to guide and steady the hand. To line straight, keep your eye on the quill end of the liner, and not on the end of the liner. When the lining is quite dry wash down with clean cold water, dry with sponge and leather, and give the body and wheels a good coat of flowing best carriage varnish in a warm room; and in painting and varnishing panels the brush must be stroked down from top to bottom of the panel, and never crossways, or the varnish will show even to the under coats; and if the black panels show any grit, never mind, as black is the worst colour for showing up, and white one of the best for not showing when varnished.—W. P.

Soldering Wires.—NAUTICUS.—Although you did not see any heating apparatus, you may depend upon it that the men were soldering the wire joints by heat in the usual way, if they were soldering them at all. It is just possible that they may have made merely a closely twisted long joint, similar to a splice, coated this with a conducting cement, and then covered the whole with Chatterton's

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compound, or a similar insulating substance. The flux employed for soldering wires may be either resin or the ordinary soldering fluid (chloride of zinc solution or killed spirits), the latter being easier than resin. Clean the ends of the wires with a bit of emery-cloth, twist them together to form a joint, dip the joint in the soldering flux, then rub it with the hot soldering-iron previously well tinned—that is, coated with solder. Some of this solder will come off the soldering bit, and enough of it will adhere to the joint to make it secure. Wash off the excess soldering fluid with a wet sponge or rag, dry the joint by warming it, and rub some paraffin wax on the warm joint before coating it with cotton, silk, or other insulating substance. If you have a number of joints to make on fine wire, have a small ladle of melted solder handy, and dip the prepared joint in this instead of using the heated soldering bit. The cold soldering recipes you have seen in books only apply to metallic cements for mending fractures in cast ornamental articles.—G. E. B.

Electric Light for Bicycle.—CYCLIST.—You cannot fix an electric light in your "spring back lamp as a substitute for burning oil;" but you may get made for your own use an electric light set, composed of an electric lamp set in a white enamelled reflector, and a small battery made of ebonite cells. Messrs. Cathcart and Peto, Electrical Engineers, 57B, Hatton Garden, London, E.C., inform me that they make sets suitable for the purpose. Each set measures externally 3⅜ in. by 2 in. by 4½ in., and weighs about 2 lbs. The price complete is 35s. the set.—G. E. B.

Relacquering Zinc.—MARKWELL (*Brixton*).—Zinc can be as readily relacquered as any other metal. The metal must be quite clean, and must be heated before the lacquer is applied. Any instructions previously given will apply equally to your particular job.—G. E. B.

How to Make a Landing Net.—F. J. C. (*Maidstone*).—Follow the general instructions given for netting a hammock on the front page of No. 79, Vol. II. of WORK. Get a ring of ¼ in. brass wire 15 in. in diameter, or better still, make a frame out of two pieces of whalebone bent and hinged to form a collapsible ring. Make the first chain of meshes out of stout netting twine in ½ in. meshes, long enough to take in the circumference of the ring. Then follow on with the same size mesh, in finer twine, in one direction round and round for some three or four rounds. After this, abate the number of meshes by dropping three in each alternate round at equal distances apart, and thus gradually bring the net to a taper point at the bottom. Finish off with a grummet or ring of the twine, ¼ in. in diameter, whipped with a bit of white thread. Fasten the net to the ring with two half-hitches of twine in each mesh. The net must be dressed as a fishing-line, and carefully washed and dried after each time of using, to prevent bad effects of damp.—G. E. B.

Dissolving Gold from Engraved Surface.—BLACKBIRD.—Two parts hydrochloric acid to one part of nitric acid is the right mixture to use for dissolving gold, but this will frost the surface of an engraving, and leave it dull. If you dilute the acid mixture with water, its action will be less energetic, and it will not corrode the surface so rapidly. You may dissolve off some of the gold in a solution of potassium cyanide by sending an electric current from the engraved article through the solution to another article—that is, make the engraved article an anode in an electro-gilding bath. This also will rough the surface, which must be got up afterwards by scratch-brushing and polishing the article.—G. E. B.

Emulsion.—AMMATURE.—Abney's books are the best in every respect and thoroughly reliable, and if the directions given in them are thoroughly carried out the experimenter ought to succeed. The following is a simple form: Dissolve 100 grains of hard gelatine in 3 ounces of pure water, in which 32 grains of bromide of ammonium have been previously dissolved. This is done by soaking the gelatine for a few hours in the water and bromide until it swells up and becomes soft, then put it into a water bath, and apply heat until the gelatine is quite dissolved; this must then be put into an opaque bottle—ginger-beer bottle, for instance—and 55 grains of crystal of silver nitrate added little by little, shaking up well between each addition until the whole is dissolved. Pour this out into a dish to set; when it has done so, squeeze it through some coarse canvas into cold running water, and let it wash for five hours to remove the soluble salts; gather it from the water, and place on a hair sieve to drain for some hours. It may now be replaced in the bottle, which can be set in some hot water to melt, and when melted should measure 5 ounces; if it does not, make up the quantity with water, add 5 drachms of spirit of wine, and filter through washleather; it is then ready for coating either plates or paper. Any smooth pure paper will do; saxe paper is perhaps as good as any. They require no preparation, being merely drawn over the surface of the melted warm emulsion, and hung up to dry, avoiding air-bubbles. All these processes must be conducted in a weak ruby light. A paper that AMMATURE may find meet his wishes is simply made by floating ready sensitised matt or albumen paper on a 10 per cent. solution of bromide of ammonium for a few minutes, and drying in the dark: this may be developed in the same manner as the ordinary bromide paper.—D.

Tuning Concertina.—J. M. (*Bayham*).—You do not say whether the concertina you want to tune is English, Anglo-German, or German, or if single-note, organ, or "celestial." If it is an English one, and wants thoroughly tuning, do not attempt it, or you will get into a muddle; it will be far better to send it to a maker who will do it properly and cheaply; about 4s. is a fair average, or, if damaged, in proportion. If only a few notes are out of tune you may proceed as follows. First find out which are the faulty notes by sounding each one with its octave, then carefully take out the six long screws and take off the top. You now have the "pan-board" and the *draw* notes exposed to view. Take the pan out by inserting the forefinger in the central hole and pulling it straight up. (Before doing this, however, note carefully the exact position of the pan in the box, so that you may be sure of replacing it in that position.) The *press* notes will now be seen on the under side of the pan, and a circular label will be found in the centre which shows the name and position of each note. Remove the offender by pushing it straight out from its groove with a blunt tool, such as a screwdriver, pressed against the clamp, and if it is too sharp, remove a small portion of the metal of the reed at the *head* by scraping with a penknife or very lightly filing it with a small file. If too flat, alter it by scraping or filing it at the tip, in either case having previously placed a piece of very thin sheet metal or parchment under the reed, to prevent its being bent or pressed down during the operation, which would prevent its speaking freely. Do not do too much filing; a mere touch, especially at the head, is quite sufficient to make a considerable alteration, and if it is filed too much the quality or, as it is called, the "voicing" of the note is likely to be altered. Before replacing, hold the note up edgeways to the light, and you ought to be able to see between the reed and the plate for two-thirds of its length. This applies to all "free reeds" (except curved or bent ones), the larger notes of course requiring more spring than the smaller ones; but it will be a pretty safe guide to give a note from the middle of the concertina a spring of about the thickness of a visiting card. You can now replace the note and the top, and proceed to try it with its octave. If it is free from "beats," or waving, it is in tune; if not, proceed as before till you get it right. The best way of trying the notes is to seat yourself on a chair, and, taking a pin that has had its point flattened out, press down the key of the octave to the note you are tuning, and insert the pin between the key and the cloth bushing, which will hold the note down, and you can then hold the lower head of the concertina tightly between the knees, while the upper one can be held firmly in position with the hands, and the thumbs are free to try the notes. If, on trying the notes previous to tuning, any are found so flat as to be discordant, it is useless to attempt to sharpen them, as the flatness is owing to a flaw in the metal itself, and it would drop out of tune again directly. These remarks apply equally to the Anglo-German, which works upon exactly the same principle as the English concertina, except that the English is known as double-action—that is, press and draw notes are both of the same pitch, while the Anglo-German has a difference of a tone or semitone between draw and press of the same key.—R. F.

Model Cutter.—H. G. (*Dulwich*).—Wait patiently for the article on this subject. Use good white pine for the hull, and yellow for mast and spars. The dimensions given in previous reply are all that are necessary.—G. J. E.

Sawing Machine.—OLD BOY.—An article will shortly appear showing how a serviceable and powerful machine may be constructed at a low cost.—ED.

Tools, etc., for Engraving on Metal.—W. B. (*Newport*).—The only firm with which I am acquainted who deal in *all tools* for engraving on copper, steel, and other engraving, is Messrs. John Sellers & Sons, Arundel Street, Sheffield. Their prices rule rather high, but the tools generally are of the highest quality, so that the extra expense at the outset is usually the most economical in the end. In answer to your second query, I do not know of any book upon engraving on metal. There are several books upon wood engraving and etching, but none, so far as I know, on metal engraving. You will, however, find articles on the subject of engraving in the various encyclopædias—notably, the "English," and which is also illustrated—but as they merely skim the surface of the subject, a learner would hardly gather much information, which is chiefly technical. You will find a short article, fully illustrated, running through Nos. 33, 38, 43, 45, and 48, in the first volume of WORK, and from which I hope you may gain some useful information.—N. M.

Hand Camera.—SAUL.—If you can manage to make an instrument of the kind designed, it should not be difficult for you to construct one of the magazine pattern. There are so many devices—and good ones, too—for effecting a change of plates in a simple manner, that it is somewhat difficult to say which is best. Perhaps one most easily made is when the plates are contained in sheaths and set one behind the other, and pressed up to register by a spring at the back. A light tight bag is attached to the upper part of the camera, the plate exposed being lifted by the finger and thumb, and placed at the back of the others, a piece of wood dividing the exposed and unexposed plates. When this is reached, it is known all the plates have been exposed. A small projection on the top edge of the sheath will assist in counting how many plates are either used or not. In an instrument of this pattern, the number of plates is only limited by the length of the receptacle. Another kind is when the plates are merely backed with opaque paper, just turned over the front edges, and placed behind each other, pressed into register by a spring; after exposure a catch is removed by means of a milled-headed button on the outside of the camera, supporting the plate by its lower edge, and the plate falls into a space below, a weak spring giving it the necessary tilt, compelling it to fall face upwards on the plates below, where it is retained in place by springs. Another simple form is where the plates are held in position like the views in a revolving stereoscope, and kept in register by a lever and button; in this form the plates are fixed in sheaths, which are attached to a small endless band, and by the turn of a button brought one after another into position, an index and pointer showing how many plates have been set for exposure. The list of cameras of this kind is very numerous; the general idea in all is to place a plate in correct position, removing it after exposure with as little trouble and expedition as possible.—E. D.

Book on Graining.—J. K. (*Watford*).—"The Plumber, Painter, and Glazier," 1s., Houston and Sons.—K.

Blisters in Paint.—PAINTER.—Some believe blisters to be caused solely from the presence of water under the paint skin; others vouch that gases and not steam are the direct cause of the nuisance. It is difficult to give an authoritative answer to your query. Are the iron cases free from *every trace* of water or greasiness before painting? If they show rust when blisters peel off, it looks very much like water; there is evidently a want of cohesion between the iron and the first coating. If this is a question of primary importance to you, I would advise you to write to Mr. E. Mathieson, Ardrossan, near Glasgow, for a copy of his book; he will probably let you have it at a greatly reduced price. It is the only real attempt to grapple with "blisters" that I know of. Try also the "Paint Preserver" of the Church Manufacturing Company, Pomeroy Street, S.E. It is a remarkable production, and worth experimenting with.—F. P.

Patches in Painted Woodwork.—ARNOLD.—The "ugly brown patches coming through the paint" after three coats of white-lead paint has been given are very easily accounted for. It is the resin in the knots discolouring the lead paint, and exuding out of the wood. On page 699, Vol. I. of WORK, paragraph commencing with, "Paint is something like," etc., you will find this matter explained. If you did use knotting—I expect not—it was very inferior in quality. Go to a decent shop, and be sure you get the right thing; do not be put off with a drop of polish, etc. Your remedy is to give the places a thin coat, or two thin coats, of "knotting composition;" then make up the white again—use raw linseed instead of *boiled* ditto—in proportions as before. Then touch up the knots twice with the paint, and give one coat all over to get once more a solid uniform appearance. Four coats are none too many, so there is not much harm done after all.—F. P.

Vandyke Brown.—VANDYKE.—The trouble you complain of when using this pigment is not common to such. I should think it is due to either being of an inferior quality or to being greasy, or else there is something wrong with the grounding paint. Get a little pigment from elsewhere. Vandyke should be purchased ready ground in water, and of the best quality only. Perhaps there is no necessity to use it so thick as you speak of; for walnut, you know, there is ivory black, burnt sienna, and vandyke, to get variety of tone with, separately or mixed, as we like. See paper on "Walnut Graining" in WORK.—LONDON DECORATOR.

Marbling.—YOKEL.—The only lithographed colour examples are such as were given with various issues of the *Journal of Decorative Art* (15, St. Anne Street, Manchester) a year or so back. *Dove marble* is of a grey colour; it may be simply imitated. Paint the ground a light leaden tint of blue; make some of a darker shade, and with a feather put in veins and markings across the block or panel; use thin black in the same manner, but rather sparingly; then put in white streaks, and soften all with a stiff softener; when dry, scumble with thin white and put in solid touches of white.—F. P.

Paint for Venetian Blinds.—J. S. W. (*Macclesfield*).—An answer bearing upon this subject will be found on page 780, Vol. I. of WORK. The laths can be easily painted in the usual manner. Let them be first thoroughly washed with soda, then coated with white-lead paint (of desired tint), and finished with a coat of enamel paint, or two coats white-lead paint, and then one coat of light copal varnish. The grey tint can be made by the addition of a little red, blue, or black pigments. A substitute for enamel would be white lead mixed with copal varnish only. New blinds require a first coating of "knotting composition."—F. P.

Cabinet and Overmantel Designs.—S. D. (*Brixton*).—There have been many of these in Vol. I. of WORK. Buy the Index to that volume for one penny, and the whole contents of the volume will be before you. Then obtain the numbers you want through your bookseller, or of Messrs. Cassell and Co., London, E.C.

Pack-saddle.—SADDLE.—The number of Captain H. R. Newburgh-Stewart's Patent, December 1, 1887,

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No. 16,540, price 4d. His address is Travers' House, Windsor, Berks. A direct communication with him is the very best course.—J. C. K.

Enamel.—C. M. (*Brighton*).—I do not know what you mean by the "white enamel preparation used by makers of overmantels before ebonising." You must be confounding it with some filling you have seen used or the preparation which is used sometimes when the work is to be polished bright on cheap overmantels. If your frames are anything you want to finish well, let me recommend you to finish them by French polishing in the usual way. If, however, you do not care for this, coat them with a mixture of size and whiting.—D. D.

Recipe for Blacking.—J. W. (*Barnsbury, N.*).—The following recipe, taken from McQuhae's "Decorators' and Artisans' Handbook," may be useful to you and others who are inquiring after this sort of thing:—Four ounces of ivory black, three ounces of the coarsest soft sugar, one pint of small beer, and half an ounce of oil of vitriol. Mix them gradually cold.

Banjo Making.—J. S. (*Glasgow*).—The banjos used by professional players are lined with wood inside the hoop; there may be exceptions to the rule, but all first-class banjos that I have seen have had the hoop lined. There are various new styles of banjos with metal hoops, but no linings to them, in the market; but I have not heard of one which could be at all compared with a hoop made of German silver, edges spun over two steel wires, and lined with wood inside. A number of new notions by myself and other makers have been tried, but up to the time of writing the ordinary model still holds its own. To ensure making a banjo with a good tone, such a one as you desire, you must make a good hoop, line it with wood, fit it with a band with a recess turned in it, or notches filed in it to keep the wires of the brackets from cutting into the vellum; use the best brackets only, for if you buy brackets that as soon as you put any pressure on them the threads strip off, you never will make a banjo to your satisfaction. Use a "Roger" vellum; they are more expensive than the common ones, but the superior results attained by their use more than compensate for the difference in price. When a vellum is properly pulled down and set, it should feel almost as tight and hard as a piece of board when pressure is applied by the thumb or finger. I should certainly give preference to a vellum all white, provided it was of a uniform thickness all round. I would not have a transparent vellum on my own banjo at any price. Banjo players, like other musicians, have their little fads when ordering a banjo to be made: one would like the vellum to have a small transparent patch on it, another would like it half transparent and half white, another all white, and so on. In selecting vellums, it requires care and judgment, only to be obtained by practice and experience (at times, dearly bought); it would not do to be guided solely by the colour of a vellum, as I have seen many which have been nice and white, but which I could not conscientiously use if I wanted to do justice to my customers. I cannot tell you anything about the metal you mention (silveroide), having had no experience with it. I have just made and introduced a banjo with hoop and band made of pure aluminium, which is much lighter than the ordinary metal "jos," about five times lighter than brass, taking equal proportions in size and thickness of each metal. The tone is very good, but I prefer the G. S. hoop. The vellum must not touch the wood lining inside metal hoop, but must rest on spur over edge of the metal. There are a number of banjos imported here from America (warranted *real American* make); the hoops of which comprise an outside casing of thin metal; the bottom edge is spun over a wire, with a thick wood lining; the edge of metal casing finishes a little below the top edge of wood lining. When the vellum is pulled down tight the edge of the metal casing is very apt to cut it, or if it does not do so, the band, not being properly recessed, allows the wires of the brackets to pull into it and cut it. Do not make your banjo after this last-mentioned style, or you will not be able to get the tone you wish for.—J. G. W.

Bookbinding.—J. G. B. (*Stratford, E.*).—I have analysed your note, and have reduced it to three questions. (1) Do bookbinders use any particular form of apparatus to stamp circles on books?—Yes. (2) Is the book laid on brass circles such as printers use?—No. (3) Are such circles and gold lettering done with separate handle letters and circles?—No. —G. C.

Gold Lines.—ANXIOUS.—You want to know how to put gold lines and stamps upon velvet. This is a very difficult process: one which even the best of finishers cannot accomplish at all times in a satisfactory manner. It requires very careful manipulation. I will endeavour to describe the process, and would advise you to make experiment with waste pieces, as you are sure to spoil not a few when you begin. The same details will be necessary whether you are using lines or stamps of any design. Velvet cannot be prepared for gilding by any of the processes already described for leather work. It must not be damped in any way, and the glaire used for leather and cloth would stain it if worked over the surface. There are at least three powders used for making the gold "stick," as we say. One of them is dried white of eggs reduced to powder; another is gum sandrac; while the third is resin: both of these are powdered like the eggs. Either of these can be used, but the gum is the best; it must be reduced very fine, and it is best to be put into a bottle and a piece of fine muslin tied over it: by this means it can be dusted over the part to be gilded. When the powder has been applied the gold is cut to the required size, and lifted on the roll or stamp. The design is then firmly impressed and the superfluous gold wiped off. The tools of course must be heated. When the design is large, it is usual to work it out on paper, and laying it upon the velvet, impress it through, and afterwards go over the design, glairing it with a camel-hair pencil; and when dry, lay on the gold, re-impress the tools as directed for leather work, and when finished, rub off the superfluous gold with a clean rag. As to exactness and regularity, it would certainly be best to accustom yourself to do this without any special tools or appliances. You might, when you have dusted on the powder, draw a line, by means of the straight-edge and a pencil point, and work to the line so drawn. Slight division marks might be made the same way. You could also make lines and marks with chalk; but you must be careful, as velvet is easily marked and stained.—G. C.

Venetian Blinds.—J. J. (*Hadfield*).—Though for many years I was engaged in making Venetian blinds, I never used a paint-box for painting the laths; I have heard of a trough being used for the purpose, which I suppose J. J. means. I regard this trough as a slow, messy, and wasteful contrivance, only useful to a heavy-handed workman, who is quite unsuitable for a blind painter. Laths for blinds are best painted, held by the operator's forefinger and thumb by one of the upper holes, the lower end of the lath being stopped by two small nails driven into a clean board which is resting in an inclined position on the edge of the bench; the slope is to prevent the paint accumulating at the end of the lath. As to a punching-press to make the holes, Reynolds & Co., Acorn Works, Edward Street, Blackfriars Road, S.E.; or Hawkins, 126, London Road, Southwark, each supply a machine which is good and reasonable in price. If J. J. means the varnish used to mix with green, which was so frequently used formerly, turpentine varnish is the article; it has the power to develop the colour in a wonderful manner. This green is not so much used now, as it is poisonous, though I never heard of any mischief from its use. Without the varnish the same quantity of green would only just tint the paint, though a full colour was produced with the varnish. If J. J. means that the blinds are painted and are now to be varnished, the varnish depends on the colour. If blue or grey, the varnish should be the palest of carriage or copal varnish, though what is called maple varnish will do as well. If a stone, buff, drab, any of the reds or browns, greens, or any tints of them, oak varnish will do if of good quality. If J. J. is speaking of blinds not painted, let him stain them, if desired; give two coats of patent size diluted with one-third water, and varnish with best church oak. An article is in the Editor's hands on the subject of Venetian blinds which may help. I could have made this answer shorter if J. J. had been more explicit; but I hope it may be of use to some others, so I give this rather prolix reply, and trust that our worthy Editor may not have to use his shears; but it would be much better if querists would be more definite. Longer questions would require less bulky replies.—B. A. B.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Gypsum.—GYPSUM (*Larnaca*) writes:—"Will any reader kindly inform me how gypsum is burnt in England, and when with coal or coke, what system of oven or kiln is used? I principally want to know how to prevent the smoke from going through the kiln and making the surface of gypsum stone black."

Gear Wheels.—STOCKTON-ON-TEES writes:—"Can any reader inform me where I can buy small steel machine-cut gear wheels? This will oblige."

Cheap Lathes.—ENGINEER writes:—"Can any reader give me the names and addresses of cheap makers of lathes? I have not much money to begin with, and I want to avoid the merchant's profits. I should like to know where I can buy one direct."

IV.—QUESTION ANSWERED BY A CORRESPONDENT.

Telephone District and Section.—TELEPHONIST writes:—"In reply to INQUIRER (see page 506), you can buy telephones which are free from the claims of the National Telephone Companies, but they are not practical instruments at all. I would advise you to wait until December 9, 1890, when Bell's patent expires: this you can use both as transmitter and receiver; the carbon transmitter patent is not free until July, 1891. If you require to open a district for telephone subscribers on the exchange principle, you will have to apply to the Secretary, General Post Office, London, for a licence."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—TYRO; ZERO; R. H. W. (*London, S.E.*); J. E. S. (*London, S.W.*); J. C. (*Belfast*); F. L. (*Snettisham*); R. S. (*Norfolk*); YOUNG CHIP; R. G. (*Preston*); SUGAR BOILER; C. H. (*Whitley*); G. W. (*Brockley, S.E.*); H. R. (*Northampton*); T. E. W. (*Hull*); A. H. D. (*Birmingham*); J. M. MC (*Westport*); J. LE M. (*Guernsey*); NEMO (*Lynn*); A. A. (*Duffield*); YOKEL; H. R. (*Paddington*); HARWICH; T. J. (*Tredegar*); GRATEFUL FRIEND; INDEX; SMITH; R. O. (*Sheffield*); W. E. P. (*Manchester*); A. B. C.; T. W. V. (*Leicester*); J. D. (*Glasgow*); F. P. (*Andover*); S. H. B. (*Barnstaple*); J. W. M. (*South Shields*); J. A. W. (*Glasgow*); R. H. (*Accrington*); R. L. H. (*Glasgow*); J. H. (*Pemberton*); LEO (*Wigan*).

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Repoussé.—"The Manual on Repoussé," by John Harrison, Birmingham, referred to in WORK, No. 85, may now be obtained from nearly all artists' repositories in London, Glasgow, and Birmingham. Price 6d. [6 s

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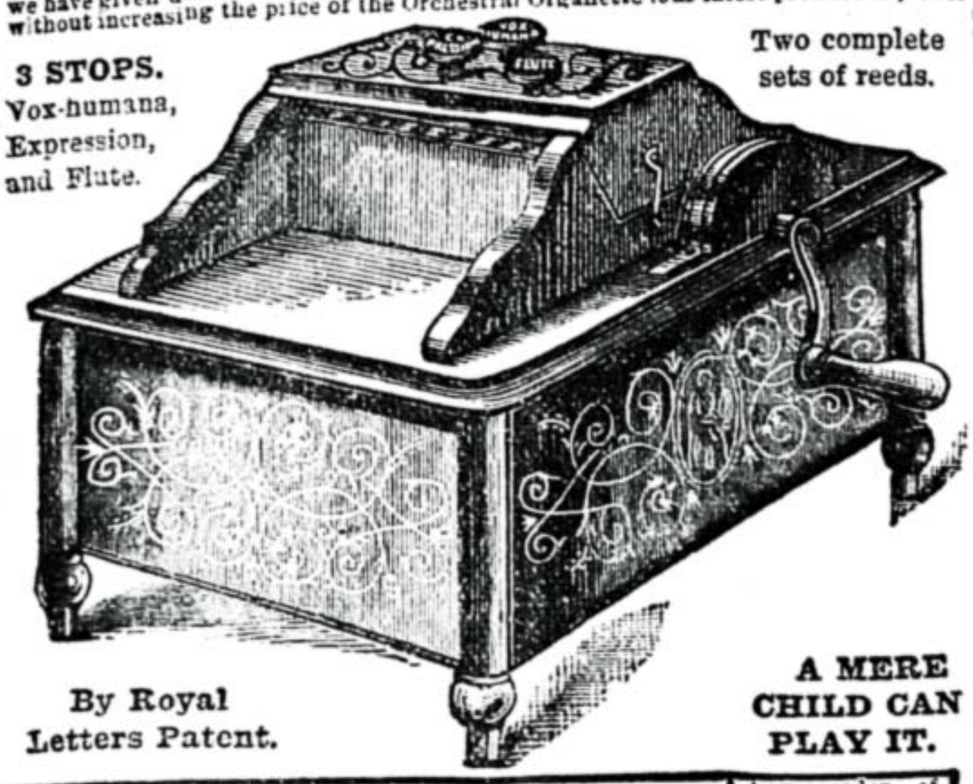

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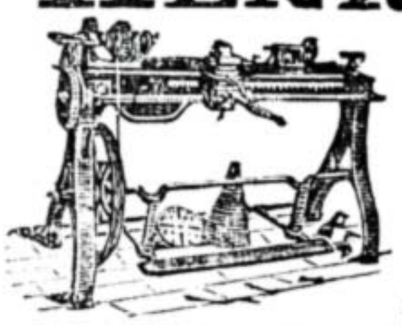

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